Peacemaking, Complex Emergencies, and Disaster Response: What Happens, How Do You Respond?

E.D. McGrady

Center for Naval Analyses

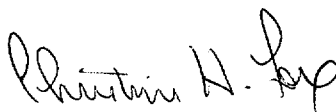4401 Ford Avenue • Alexandria, Virginia 22302-1498

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Contributors: Laura A. Geis, Peter M. Swartz, Betsy Jacobs, Jonathan T. Dworkin

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Christine H. Fox, Director
Operational Policy Team
Policy, Strategy, and Forces Division

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Contents

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Summary

In this paper we examine some of the requirements for disaster relief operations.

This paper is part of a larger project for Commander in Chief, Pacific Fleet (CINCPACFLT) examining the ability of afloat naval forces to respond to disasters and other emergencies in the CINCPACFLT area of interest. Other papers in this series examine different aspects of afloat forces assisting in disaster relief operations. For an examination of the capabilities of afloat forces to respond to disasters, see [1]. For a synthesis of the work contained in this paper and [1], see [2].

In this paper we attempt to answer three interrelated questions:

- What disasters are likely to occur in CINCPACFLT's area of interest?

- How do these disasters evolve?

- What response is required, and who meets those requirements when the military does not show up?

If you expand CINCPACFLT's area of interest to include those regions where CINCPACFLT may be called on to resource forces in support of another CINC, it turns out that almost every type of disaster occurs in CINCPACFLT's area of interest. They range from natural disasters (earthquakes, floods, droughts, typhoons) in the Pacific basin, to complex emergencies along the east coast of Africa and the Asian subcontinent (Afghanistan).

Although many disasters occur that CINCPACFLT may be interested in, military forces become involved in only a few of them every year. This winnowing process occurs across the spectrum of possible response; only the indigenous disaster management organization (if any) is guaranteed to respond to a particular disaster. The

international community, the U.S. government, and the U.S. military respond to only a fraction of the disasters that occur.

Disasters evolve along a well-known trajectory. We have looked at the timelines for various types of disasters. Actual disaster data show that there is often a delay between the point of which it is inevitable that the disaster will strike, and the arrival of the first response. For complex emergencies, this time difference can be considerable; it can be days or a week for even rapid-onset disasters.

Afloat forces can exploit this time difference to mitigate against their need to sail (vs. fly) to a disaster. If they begin moving at the first sign of trouble, they may arrive at about the same time as aircraft. However, this also means that afloat forces are more dependent on information about where and when a disaster will strike that could involve U.S. military forces.

Many participants in international disaster response are beginning to develop disaster prediction and tracking capabilities. These include predicting floods and droughts, mapping vulnerable populations, and analyzing vulnerability to natural disaster. The key finding is that afloat forces, because they are so dependent on rapid prediction and understanding of when and where they will need to respond, need to incorporate these models and prediction tools into their daily intelligence collection, dissemination, and operations process.

Requirements for disaster response can vary widely according to the type of disaster, but vary less between events of the same general type. In other words, relief requirements for hurricanes resemble those for typhoons and other storm events more than they resemble those for droughts or earthquakes. But overall, the requirements for transportation of relief goods is a consistent requirement across the spectrum of disasters. Likewise, the need for basic relief supplies—food, water, and shelter—is consistent across disasters. It is in the specialty requirements, such as medical care, that disaster relief efforts will differ the most.

Another consistent fact we find in examining disaster relief operations is the growing capability of the non-government and international communities to respond. International organizations are

beginning to build sophisticated command, control, and logistics information systems to allow disasters to be predicted and relief operations tracked. Likewise, the use of aircraft, ships, and land vehicles owned or leased by the relief agencies is a common practice.

Developed and developing countries are beginning to build indigenous relief capabilities. Most disaster relief is handled by organizations internal to the country where the disaster occurs. Developing countries, aided by the international development community, are working towards indigenous disaster preparedness and mitigation efforts. Developed countries are increasingly drawing on the experience of the United States in dealing with large national disasters in developed economies.

With the growing number of organizations that can bring significant capability to relief efforts, the areas where military forces provide *unique* capabilities include:

- Armed conflict. There is still no substantial non-government capability to protect relief operations for hostile actions. Relief organizations routinely scale back or abandon operations in areas where there is a substantial threat to their workers.

- Large-scale disasters. Disasters that overwhelm a region or country, destroy large portions of its infrastructure, or debilitate its social and economic structures can present problems on a scale that only military forces with their self-sustainment, organization, and mobility can effectively deal with.

- Niche support. The military services can contribute some capabilities in greater numbers (helicopters, for example) or in unique ways (airborne and sea-borne command and control, for example). These niche capabilities, if configured, trained, and resourced for the mission, can provide significant on-call resources to relief operations with unique requirements.

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Introduction

Crises, disasters, and other man-made and natural calamities do one thing very well: they change the human environment from its normal condition to one that is anything but normal.[1] The process of responding to a disaster means intervening during or after the disaster in order to return the social and economic conditions to the way they were prior to the disaster (or better).

In this paper we examine the entire range of natural and human-caused disasters to identify the types of relief and response requirements of each. We attempt not only to enumerate requirements, but also to quantify them and put them in the context of the wide range of organizations that will try and meet them.

This is the environment that any military force will operate in when responding to a disaster. To identify the unique contributions that afloat naval forces can make, we must start by identifying what is required, when it is required, where it is required, and who else is going to try to meet the requirements.

A note on this paper

This project examines the role of afloat naval forces in smaller-scale contingencies for the Commander in Chief of the Pacific Fleet

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1. Throughout this text we will use the term "disaster" when referring to *any* natural or man-made calamity. This is merely our convention; you could replace it with the words "crisis," "contingency," or "emergency." We will use the term *natural disaster* when referring to disasters that are wholly the result of natural conditions (e.g., earthquake, flood); *man-made disaster* when referring to disasters caused by industrial activities (e.g., oil spills); and *complex emergency* when referring to economic, political, or social disasters that are likely to cause conflict. The taxonomic classification of disasters is a study in itself.

(CINCPACFLT). In this paper we do not examine *domestic disasters*. We do look at some aspects of domestic disaster response, but primarily as a model for disaster response in other technologically advanced countries. Of course, many of the findings would apply to domestic disasters, particularly those involving support to emergency managers in technologically advanced countries.

Likewise, because the project was done for CINCPACFLT, we do not dwell on disasters and situations (for example, Bosnia) that occur outside of the CINCPACFLT area of responsibility (AOR). We do include areas of Africa and South America in the study because forces resourced by CINCPACFLT could be called on to support operations there.

There are many technical aspects to requirements. We chose to collect technical communications and information systems requirements where they can best be compared to existing Navy capabilities, in [1]. This means that in several cases where specific telecommunications capabilities are known, they are listed in [1] instead of here.

Finally, a note on sources. Almost all of the primary source information on international, and domestic, disaster response and relief operations is now available on the Internet. ReliefWeb [3] is the primary source used for statistics and requirements for *specific* operations or crises unless otherwise noted. Many of the situation reports for domestic disasters are in the web site of the Federal Emergency Management Agency (FEMA) [4]. These sites were used in compiling information for this report. In some cases tens of hundreds of individual reports were used, too many to call out as individual references.

Why do disasters occur?

Disasters do not occur in a vacuum. If there is not a group of people (or ecosystem) that is affected by a disaster, then there is no disaster. For a particular event, or *hazard* (e.g., earthquake, tsunami, drought, or flooding) to affect a population, that population must be both exposed and *vulnerable* to its effects [5–7].

The three categories of disaster that we use in this paper—natural disasters, complex emergencies, and man-made disasters—result from different (but often interrelated) types of vulnerabilities in the affected populations. In the case of complex emergencies, the population's vulnerability often comes from political, economic, or social circumstances. These vulnerabilities include poverty, repression, ethnic conflict, or discrimination. Once a population is vulnerable, any additional stress can send it into a crisis.

Exposure to natural disasters often comes about from a combination of poor location and lack of preparedness. Effects of a natural disaster can be made worse by lack of preparedness or mitigation efforts. Examples of preparedness measures include:

- Dikes in flood-prone regions

- Storm shelters in typhoon regions

- Building codes that prevent masonry buildings from being built on top of an earthquake fault.

As is the case with complex emergencies, natural or man-made disasters can be made much worse when political, economic, or social conditions increase a population's vulnerability.

What happens during a disaster?

Figure 1 shows one way to look at disaster relief operations. In a disaster scenario the vulnerability of a population exposes it to immediate or long-term danger. This, in turn, generates requirements for relief in order to reduce or eliminate the population's vulnerability. The response forms a series of building blocks that attempt to answer the need for relief and rebuilding. There are a couple of important things to note about the concept of vulnerability and danger:

- The population may already be vulnerable. That is where *development* work and disaster relief interrelate. Development agencies are attempting to deal with the underlying vulnerabilities in a population that are not directly tied to a particular disaster. The level of development of a society can have a significant impact on the type of disaster relief needed; likewise, disaster

relief can have a significant impact on future development work.

- Before the disaster, *mitigation* work can occur. In the simplest cases this means building dikes and levees to channel flooding, or storm shelters against cyclones, or, in the case of technologically advanced societies, building earthquake-proof bridges and buildings or developing essential monitoring and communications warning systems. In figure 1, this is represented by the fact that "response" may occur prior to the actual event.

Figure 1.   Layers of response to a disaster [from 5]
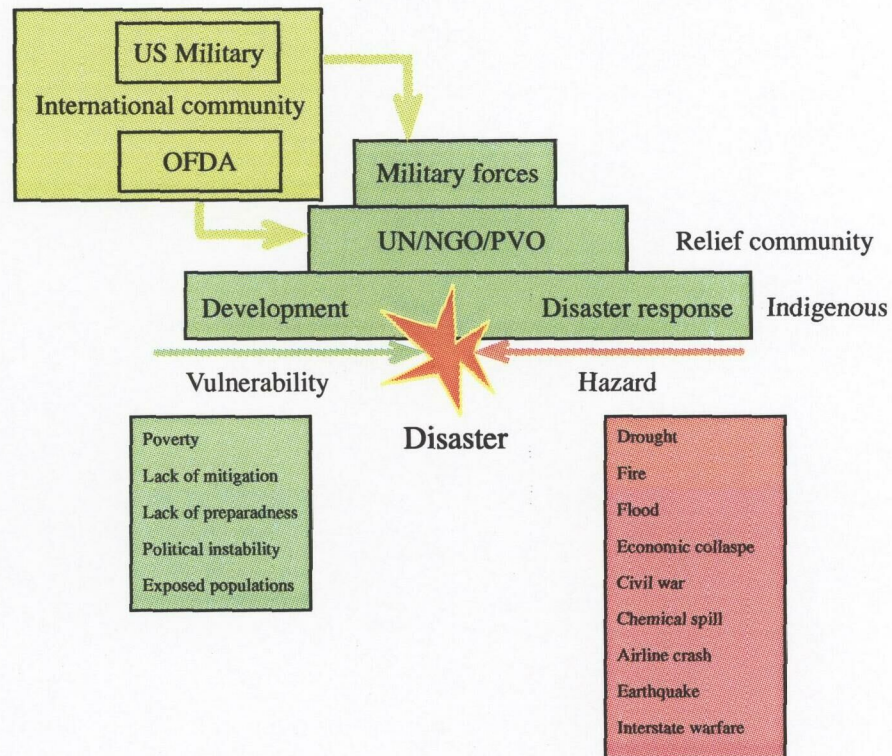
While we don't deal with either mitigation or development directly in this paper, both are important concerns for the "first responders" (NGOs, UN, OFDA, etc.) to disaster situations because they represent

part of the environment these "responder" agencies will be responding into.

Relief itself proceeds through a series of phases. The ultimate goal of relief operations is to restore the society to the same condition as before the disaster (or better). At minimum the goal is to not make things worse, though that often happens when the type of relief is not appropriate to the situation [6]. The phases of disaster relief we use in this paper are shown in figure 2.[2]

Figure 2.   Phases of disaster relief operations

Phase	Action
Monitoring, predicting, and mitigating	**Mitigation**
Assessment and relief	**Immediate response**
Rehabilitation	**Temporary recovery**
Reconstruction	**Permanent recovery**

2.   There are a variety of ways to break disaster relief operations into phases. For alternatives, see [6–7].

Types of disasters

There are many different taxonomies for disasters. In organizing disasters it is difficult to avoid mixing vulnerabilities, such as civil war or refugees, with hazards such as droughts or floods. It is also difficult to disentangle disasters that may occur in the midst of other disasters, such as flooding in an area where fighting and displaced persons already make for a complex emergency.

In this paper we divide disasters into three broad categories:

- Natural events. In turn there are two types of natural events:

  — Rapid-onset disasters. Examples include the following:

    - Storms, hurricanes, cyclones (generically, "storms")

    - Violent thunderstorms and tornadoes[3]

    - Earthquakes

    - Volcanic eruptions

    - Earth movements (lahars, landslides, mudflows)

  — Slow-onset disasters. Examples include the following:

    - Drought, desertification—including "humanitarian disasters" such as famine

    - Floods

    - Epidemics (in Africa: yellow fever, cholera, meningitis) [8]

    - Infestations (primarily locust) [8]

- Complex emergencies. There is no particularly clear definition (as is often the case in the disaster literature) of a complex emergency. For a "complex humanitarian emergency" the customary definition is: "situations in which armed conflict,

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3. We ignore disasters such as tornadoes and thunderstorms because of their limited effects and duration. (In much of the world, they are often associated with cyclonic storms anyway.)

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government repression, and/or natural disasters cause at least 300,000 civilians to depend on international humanitarian assistance"[9].[4] In this paper we will use the term "complex emergency" to denote both complex humanitarian emergencies, and complex political emergencies (emergencies that have conflict-based, rather than economically based, causes and effects). In both cases, our emphasis is on emergencies that arise out of political, economic, or social collapse regardless of scale or other aggravating circumstances (such as simultaneous natural disasters).

- Other, man-made disasters. These include the following:

  — Fires.

  — Industrial accidents.

  — Environmental disasters. These include ecological disasters, which, like acid rain, can be extremely slow in arising and very difficult to mitigate once they are noticed [6].

  — Large-scale accidents (e.g., dam bursts, shipwrecks).

  — Network failures.

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4. Alternative definitions include:

The deterioration or complete collapse of central government authority; ethnic or religious conflict and widespread human rights abuses; episodic food insecurity, frequently deteriorating into mass starvation; macroeconomic collapse involving hyperinflation, massive unemployment and net decreases in GNP; and mass population movements of displaced people and refugees escaping conflict or searching for food [10].

A humanitarian crisis in a country, region or society where there is a total or considerable breakdown of authority resulting from internal or external conflict and which requires an international response that goes beyond the mandate or capacity of any single agency and/or the ongoing UN country programme [11].

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Afloat naval forces and disaster response

The purpose of examining all these different types of disasters is to answer the question: Where do afloat naval forces fit into the overall scheme of disaster response and recovery?

U.S. naval forces respond to many different types of contingencies every day. They may provide aid to less fortunate people overseas through charitable programs or they may engage in stateside disaster recovery efforts by providing personnel and material in support of civilian efforts. Naval forces also conduct many different types of operations short of all-out warfare, including non-combatant evacuation operations (NEOs) and limited strikes.[5]

In this paper we are primarily concerned with smaller-scale contingencies (SSCs) in which naval forces have traditionally *not* played a large role, and for which naval forces have *not* developed specific doctrine, training, or systems that would provide them guideposts for their participation.[6]

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5. For a comprehensive taxonomy of all the various missions naval forces engage in, see [12–13].

6. For additional discussion of our objectives, see [2].

What types of disasters can occur?

To support disaster response, it is worthwhile examining what is likely to happen, where it might happen, and what different environments it may happen in. In later sections we will examine what happens when a particular type of disaster occurs, and what response is required for that type of disaster. In this section we limit ourselves to questions of frequency and location.

It is also useful to discuss who tracks disasters. Disasters do not fit well into the typical idea of an intelligence picture. Since their causes can range from natural to man-made or a combination of both, responsibilities can be unclear, and when resources are limited, agencies choose to track events that most closely relate to their mission. Furthermore, while military intelligence may be adept at predicting military events, it may have neither the expertise nor the charter to predict or track non-military events such as earthquakes. During the course of this project we have attempted to understand what agencies track the various components of the overall problem of disasters.

What happens?

The elements the planet is made of—air, fire, water, and earth—are the most frequent and largest contributors to disasters. Floods, droughts, storms, and earthquakes top the list as the principal contributors to loss of life, property, and social organization both domestically and around the globe. Fortunately, most disasters are dealt with by the indigenous government, often with little or no outside help.

It is when the scale of the disaster reaches the level that the indigenous relief efforts can no longer cope that the rest of the world becomes involved. When these organizations fall short in their response, the U.S. military, finally, may be called in to provide specific relief capabilities.

This means that although a lot of disasters occur, and many get some sort of international response, the U.S. military will have a substantial role in only a few of them. In this section we look at what types of disasters occur, how often large disasters occur, and where the various types of disasters are concentrated.

Worldwide disasters

In this paper we are mostly concerned about the likelihood that the Navy will have to meet certain requirements to respond to a disaster. Thus we are mostly concerned with the indicators that predict military involvement, and the frequency with which various large-scale disasters occur.

Counting disasters is a tricky business and often depends on what is reported, how it is reported, and how the data are sorted and counted. Counting by numbers of people killed will pick up all casualty-producing disasters, even small ones where the indigenous government can handle the response. Counting by appeals will show the disasters that were significant enough to generate an appeal to the world community for assistance, but governments often use appeals for reasons other than simple disaster response (and sometimes there isn't a government around to appeal). Appeals are significant because the U.S. military will typically become involved in overseas disaster relief when the disaster-stricken country appeals to the U.S. ambassador for aid, and the ambassador, in turn, requests aid from the U.S. Agency for International Development's (USAID's) Office of Foreign Disaster Assistance (OFDA).

Table 1 shows data on worldwide disasters from the International Federation of Red Cross and Red Crescent Societies (IFRC). It covers all disasters that resulted in over ten deaths or 100 people affected, or where there was an appeal. As can be seen there, the most common natural disasters are those associated with weather: high winds and floods (in reality, much of the disasters grouped into the "other" category are also weather related). Earthquakes are next most frequent; volcanoes and landslides occur much less often.

Table 1. Global disasters by year and type as reported by ICRC[a]
[14–17]

Disaster	1996	1995	1994	1971–95 (cumulative)	Yearly average
Natural trigger					
High wind	43	49	51	1,650	66
Flood	65	87	68	1,508	60
Earthquake	12	23	20	678	27
Other[b]	38	29	8	593	24
Drought and famine	4	11	4	469	19
Landslide	14	10	5	232	9
Volcano	4	4	8	110	4
Non-natural trigger					
Accident	83	62	70	1,719	69
Fire	19	19	21	628	25
Technological accident	7	8	20	343	14

a. Criteria for inclusion are 10 deaths and/or 100 affected and/or an appeal for assistance. The data are drawn from Department of Public Health, Catholic University of Louvain (Belgium) EM-DAT database.
b. Includes: avalanche, cold wave, heat wave, insect infestation, tsunami.

Man-made disasters occur nearly as frequently as wind and flood damage. "Technological" accidents (industrial accidents, spills, etc.) occur nearly as often as drought and famine during the year.

As we mentioned previously, another way of looking at disasters is to count the numbers of appeals for assistance that were consolidated by the United Nations Department of Humanitarian Affairs (UNDHA). These are shown in table 2. While this method also has inherent bias, it defines disasters according to the willingness of a government to make the political decision to ask for assistance.

Comparing the two tables clearly shows that a lot more disasters occur than actually result in an international request for aid. Even among those that result in a request, not all of the requests will involve assistance from the United States. The Office of Foreign Disaster Assistance (OFDA), part of the United States Agency for International Development Office of Humanitarian Assistance, is responsible

for providing U.S. assistance to other countries that request our aid. In some ways OFDA is the international counterpart for assistance outside the United States to the Federal Emergency Management Agency for assistance inside the United States. Table 46 in appendix A shows the natural and man-made disasters supported by OFDA for fiscal year 1997 [18].

In each of these cases, the ambassador to the country declared a disaster. Immediately upon receiving the declaration, OFDA can support an ambassador with $25,000 in aid. Beyond that, a determination by OFDA headquarters is required for project funding. In the table we show the total amount of U.S. government funds allocated to the disasters. In some cases these include DOD funds. All cases include funds from Bureau of Humanitarian Relief (BHR)/OFDA. In most cases the BHR/OFDA funds went to various NGOs that actually carried out the work. For example, the $15,200 provided to Guinea-Bissau in response to a disastrous fire in one of the villages went to Africare, a U.S. PVO. The funds then went for rebuilding materials, and to replace lost livestock [19].

Comparing table 46 in appendix A and table 2, we see that only some disaster relief efforts are funded beyond the minimum $25,000 award. Most funding by the U.S. government falls into the category of complex emergencies—in other words, large disasters with significant political, military, and social upheaval. These also tend to be centered in Africa, with two regions, the Horn of Africa and the Great Lakes, receiving the most attention in 1997. It is also apparent that, while most of the complex emergencies listed in table 46 were in Africa, most of the natural disasters resulting in response occurred in the Pacific, South America, or the Middle East (and Europe, which was not shown in the table).[7]

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7. Throughout this paper we will focus on the Pacific region in our analysis of what happens where. This does not imply that disasters do not happen in Europe and the Former Soviet Union (FSU). Many of the FSU countries have been beset in recent years with flooding, civil war, and other disasters. Likewise, Europe has several significant complex emergencies, including Bosnia and Albania.

Table 2.   Disasters resulting in appeals for assistance or international attention [20]

Disaster	1997	1996	1995	1994	Total 1990–97
Storm	13	22	18	21	134
Flood	27	24	30	28	185
Earthquake	9	8	20	16	106
Other[a]	0	0	2	0	13
Drought	7	1	0	0	9
Debris flows	1	1	3	0	17
Volcano	2	0	3	2	20
Fire	2	2	2	2	12
Technological[b]	1	2	1	1	7

a. Disease, political.
b. Cyanide mine spill, gas explosion, copper mine dam burst, oil spill, power outage.

U.S. military interventions

We have discussed where disasters occur from a general perspective, and attempted to sort them by various types of appeals and responses. One particular type of response we are interested in is U.S. military intervention. There are several past and ongoing studies of military crisis-response operations we can draw on to describe where and when military forces tend to intervene in crises [21–29].

Table 47 in appendix A provides a summary of major operations[8] arranged by type of operation. Evacuation and embassy security operations, along with refugee assistance and peacekeeping operations, have dominated the Navy and Marine Corps involvement in smaller-scale contingencies. While this is consistent with the U.S. government's tendency to provide substantial aid to complex emergencies, the scales are significantly different. In terms of numbers, the Navy and Marine Corps have participated in about as many responses to overseas storms during all of 1990–97 as the U.S. government made assistance contributions to in just FY 1997 alone.

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8.   Examples of things excluded from the category of "major operations" would be the airlift of whooping cranes, any search and rescue operation, or ad-hoc fire or flood fighting.

Many disasters occur that the U.S. government agencies do not participate in. Of the small fraction the U.S. government does participate in, the U.S. military is involved in only a few. There are currently even fewer that U.S. Navy or Marine Corps forces are involved in. The selection process is determined by appeals from the affected government and international community, appeals by the U.S. ambassador, and the ability of the Navy and Marine Corps to contribute. The Navy and Marine Corps do not become involved in large numbers of overseas responses to natural and technological disasters.

Figure 3 shows one set of *possible* reasons for this winnowing process. In the figure, events proceed from left to right. First, before anything else can happen, some organization has to determine that a disaster of sufficient magnitude has occurred. This initial definition of what is or is not a disaster of worldwide scope can significantly affect the overall disaster statistics. Next, the government responsible may or may not make an appeal for aid. While aid can occur privately for countries that do not make a direct appeal, the world community is more likely to become involved when there is an appeal. Next, the world community has to respond; many disaster appeals go unanswered.

Figure 3. Disasters and disaster response

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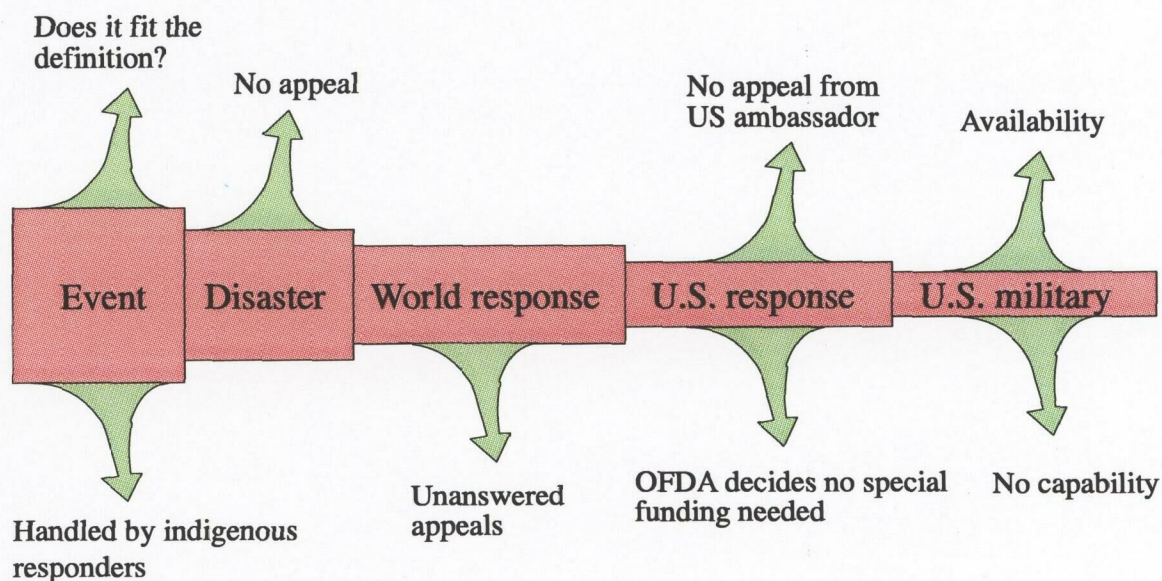
For the U.S. to become involved, the ambassador of the country where the disaster occurs has to first make an appeal. Then OFDA Washington determines whether it will sponsor additional projects beyond $25,000—the limit for a response to an ambassador's disaster declaration. Finally, if the U.S. military is going to be involved, there are even more considerations, many of which are focused around whether the military is appropriate for the mission. A look at table 47 in appendix A suggests that many military interventions focus around NEOs and other operations where there is a chance of conflict.

All of these processes take their toll on the number of disasters that will result in some sort of response. Not all disasters result in a response by the world community, and even fewer result in a response by the U.S. government.

Where do disasters happen?

Natural disasters

Detailing all of the possible locations for natural disasters is beyond the scope of this paper. We have chosen to concentrate on only a few of the many types of disasters: tropical cyclones, floods, earthquakes, volcanoes, and droughts. We use these to illustrate a few fundamental observations:

- There is a wide range of causes for natural disasters in the Pacific.

- Most types of disaster occur somewhere within the Pacific region, or the areas adjacent to the region.

- In most cases, it's well known where disasters are likely to occur—but not when they might occur or of what magnitude they will be.

Figure 4 shows storm tracks in the Pacific as reported by the Navy Weather Service Environmental Detachment. These are generalized tracks aggregated over the two tropical storm seasons. From approximately January through April, storm tracks in the Pacific are southerly from the equator toward the Antarctic. From May through December,

the storms shift with the monsoons and track northwesterly in both the eastern and western Pacific. For example, the typhoon that resulted in Operation Sea Angel hit Bangladesh the last days of April 1991, Hurricane Iniki hit Hawaii in September 1992, and Typhoon Paka hit Guam in December 1997.

Figure 4.   Tropical storm tracks [30–32][a]

May - December

January - April

Numbers represent the range of the average number of monthly cyclones along those tracks during the season.
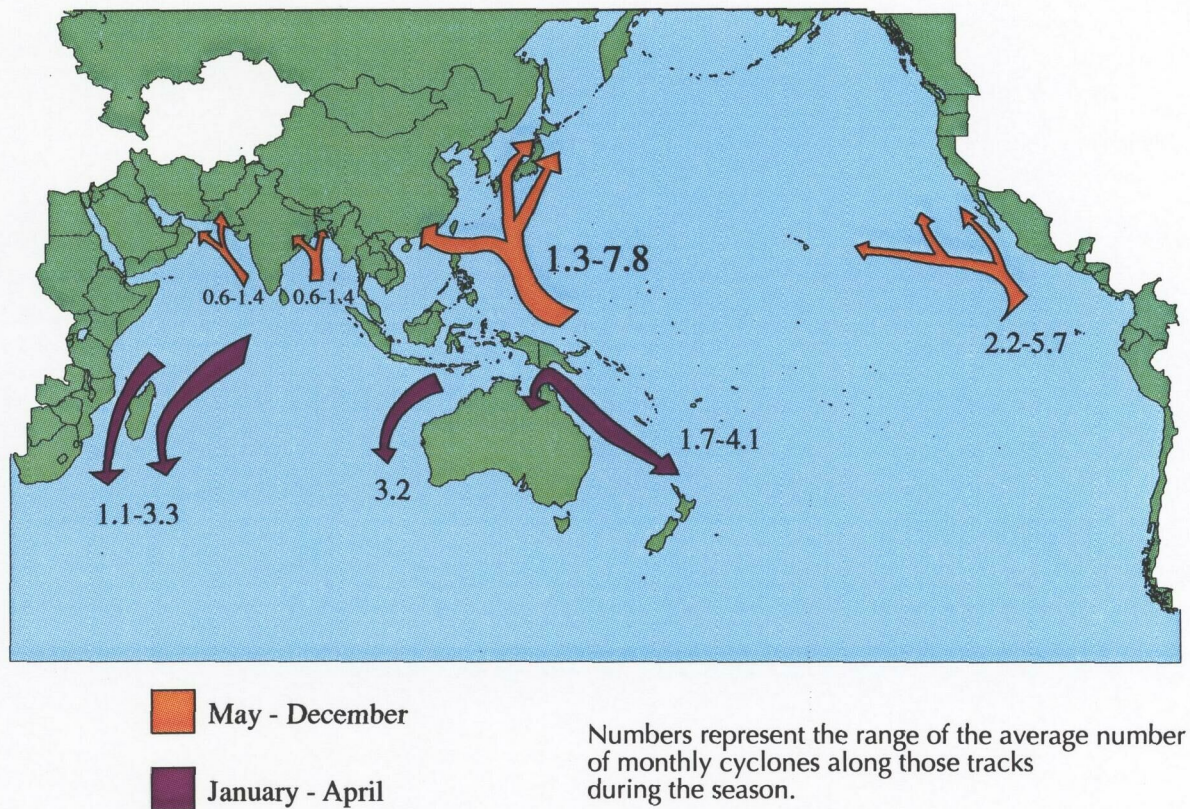
a. These are generalized storm tracks for the months indicated. Tracks will vary somewhat by month.

Figures 5 and 6 show countries where the most severe flooding occurred in 1997 and 1998.

Figure 5.   Floods 1997 [33]
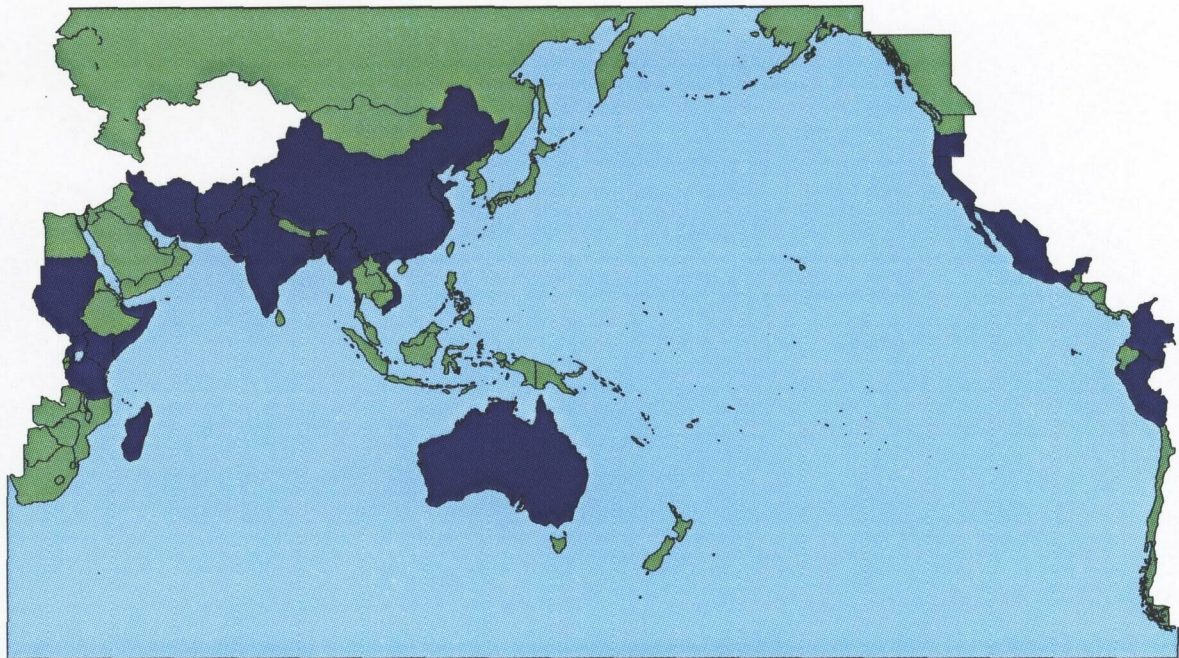
Figure 6.   Floods 1998 [33]
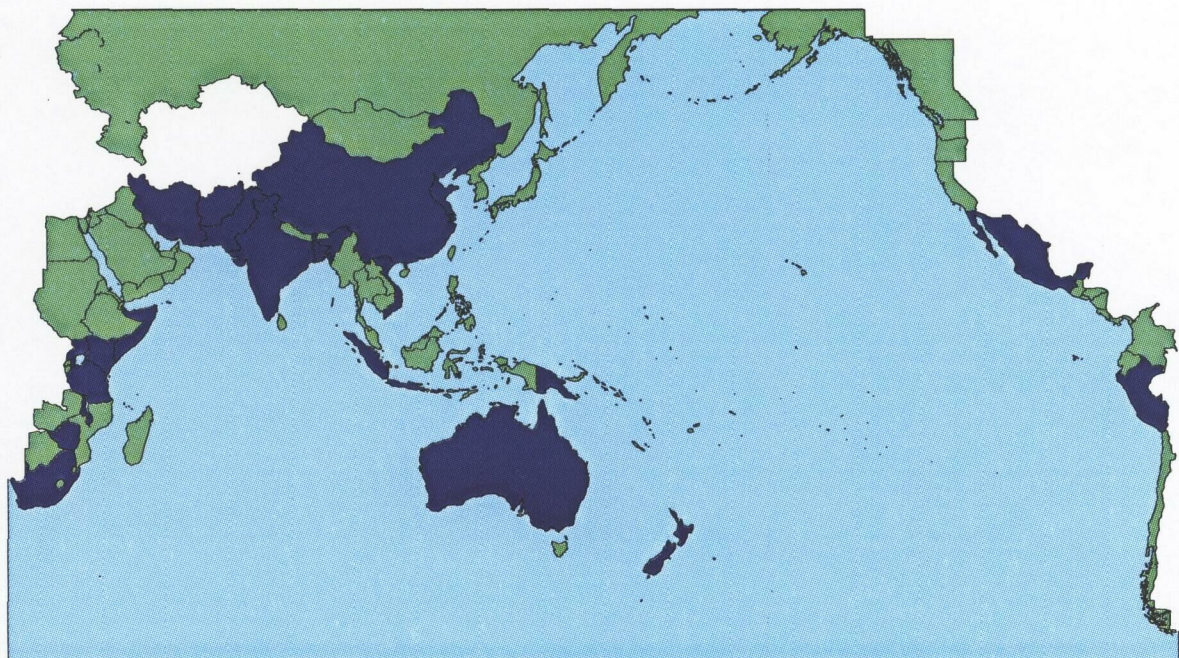
Figure 7 shows earthquakes during the past 50 years (1946–96) with magnitudes greater than 7.5 on the Richter scale. The ten largest quakes (1900–94) are highlighted in red. Only the largest earthquakes are shown, as smaller earthquakes essentially ring the Pacific basin (even adding those between 7.0 and 7.5 greatly increases the total number of quakes). Once too many events are displayed it becomes hard to single out focus areas.

Figure 7.   Large magnitude (> 7.5) earthquakes (1946–96) [34–35][a]
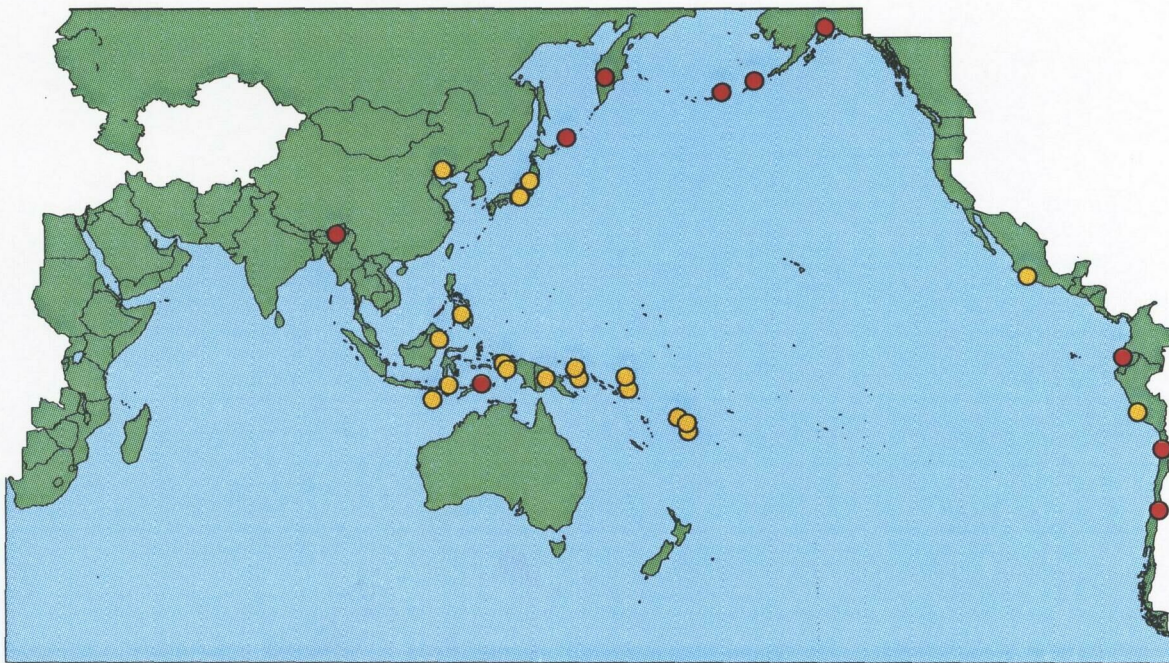
a. The ten largest quakes from 1900 to 1994 are highlighted in red.

Only two large earthquakes fell outside of the area shown in figure 7. These occurred in the Atlantic off the coasts of Spain and Morocco. Likewise, all of the largest quakes occurred in the Pacific basin. As we discussed above, magnitude is not necessarily an indicator of the amount of damage an earthquake will do. To have a dramatic effect, the earthquake must occur near a vulnerable population. However, figure 7 does give some indication of where large-magnitude earthquakes are likely to occur.

Figure 8 shows locations of major volcanic events since 1975. As with most earthquakes, volcanic events tend to be limited in scope to the immediate area affected.

Figure 8. Volcanoes with activity reports since 1975 [36]
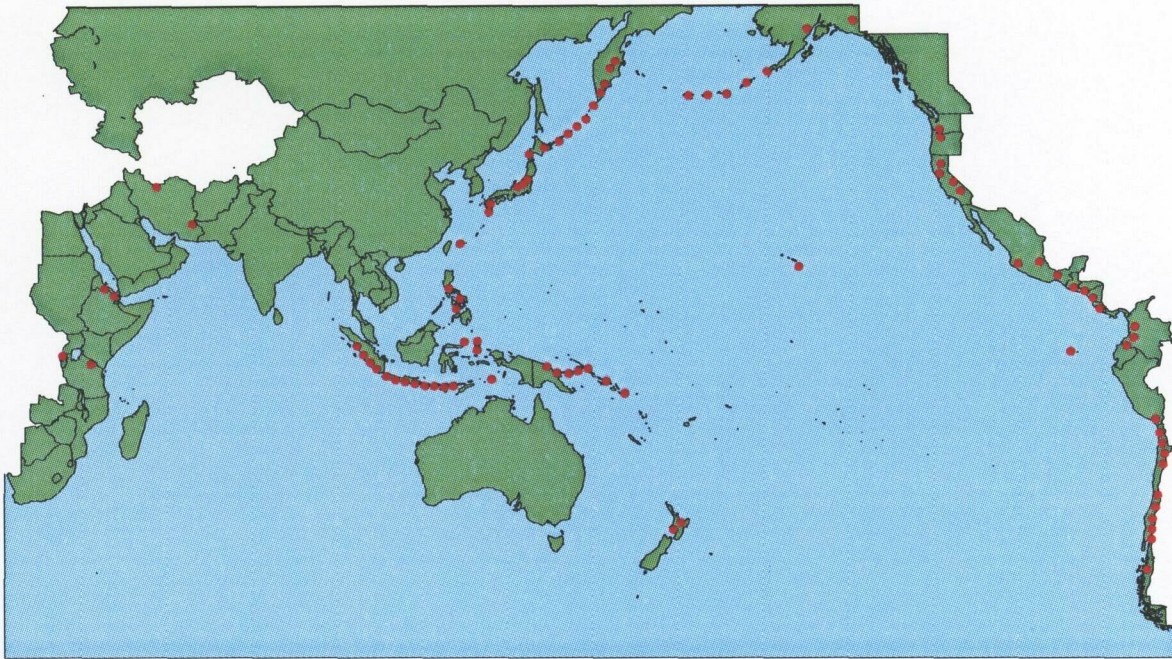
In general, the Pacific region is affected by most major forms of natural disaster. Some types of natural disasters associated with tectonic activity (the "ring of fire") may be more likely in the Pacific than elsewhere. These include earthquakes, volcanoes, and tsunamis.

Complex emergencies

As we discussed in the introduction, there are multiple definitions of what constitutes a complex emergency. Thus, different organizations may use different criteria when reporting on complex and humanitarian emergencies. This can be seen when comparing reporting by the United Nations and the United States.

Figure 9 shows complex emergencies as reported by the United Nations for 1997. During 1996 and 1997, three emergencies were added to the list: in Albania, Central African Republic, and Congo. During 1997 and 1998, three more countries were added: Guinea-Bissau, Eritrea/Ethiopia, and the Balkans.

Figure 9.   Complex emergencies as reported by the United Nations [20]
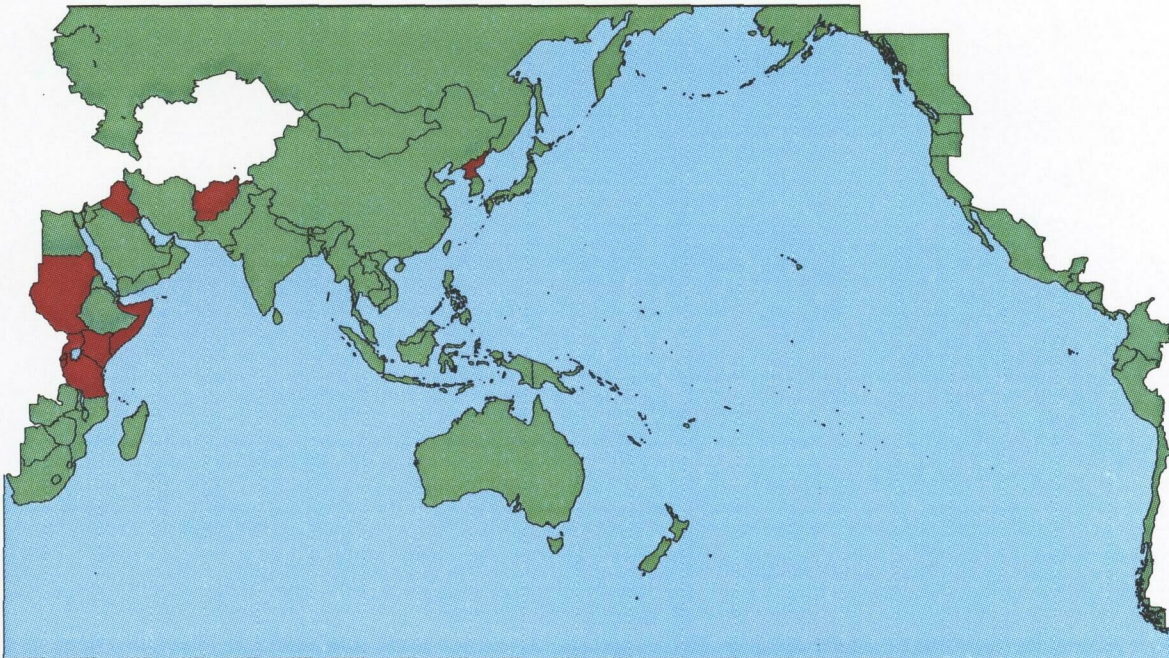
The criteria used by the United Nations when reporting complex emergencies is:

> A humanitarian crisis in a country, region or society where there is a total or considerable breakdown of authority resulting from internal or external conflict and which requires an international response that goes beyond the mandate or capacity of any single agency and/or the ongoing UN country programme. [11]

Figure 10 shows the complex emergencies as reported by the United States through the United States Mission to the United Nations. It

reports the top 20 humanitarian emergencies that fit the "at least 300,000 affected" criterion discussed in the introduction. In the figure, we also list the "worldwide hotspots" as reported by the Defense Intelligence Agency.

Figure 10. Complex emergencies reported by the United States [9]

■ U.S. and UN complex emergencies

■ UN complex emergency

⭐ DIA worldwide hotspot
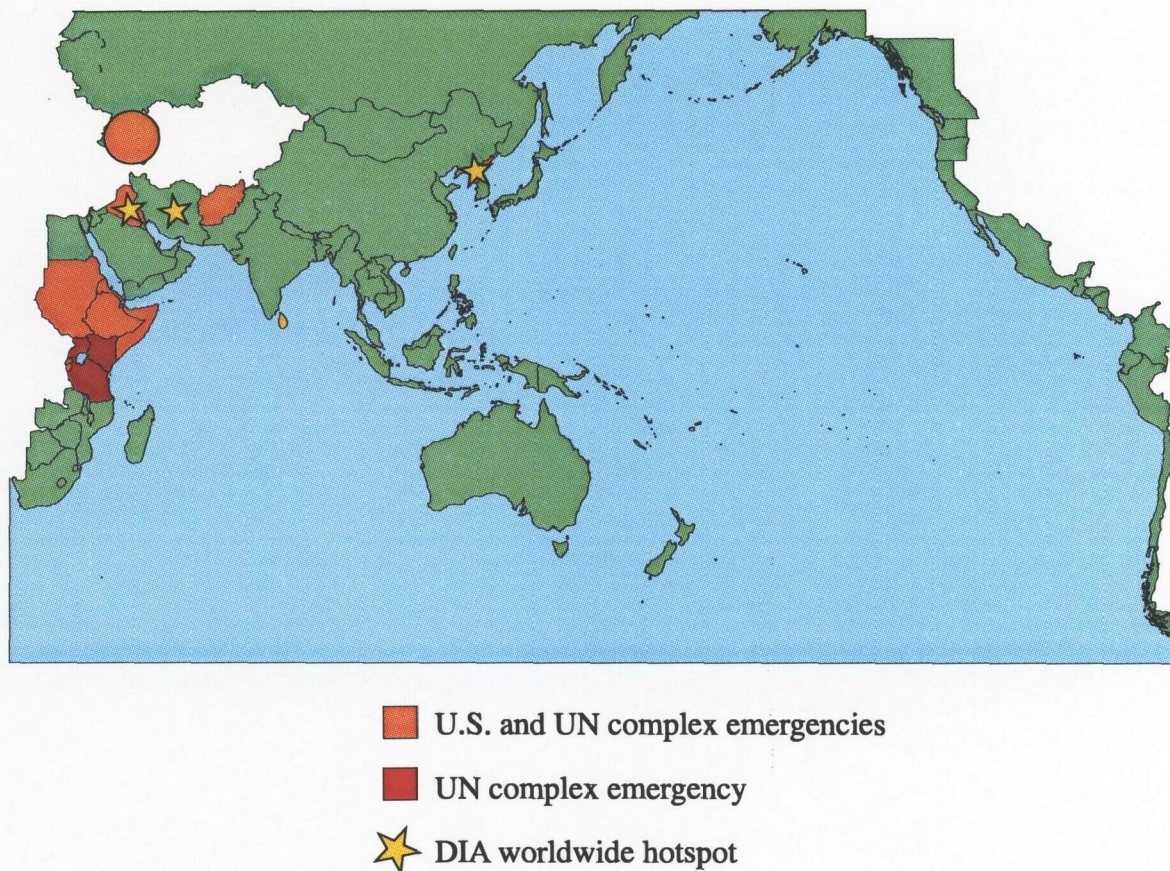
Table 3 compares the individual countries as listed by the United Nations and United States Mission to the UN. Figures 30 and 31 in appendix B show the UN- and U.S.-reported complex emergencies for the entire world.

Table 3. Worldwide humanitarian emergencies

UN, 1998	UN, 1997	U.S., 1997
Afghanistan	Afghanistan	Afghanistan
Albania		
Angola	Angola	Angola
Caucasus	Caucasus (Azerbaijan)	Azerbaijan, Georgia
Balkans		Bosnia and Herzegovina, Croatia
Eritrea/Ethiopia		Eritrea/Ethiopia
Central African Republic	Central African Republic	
Congo	Congo	
DPR Korea	DPR Korea	North Korea
		Haiti
Great Lakes (Rwanda, Burundi, etc.)	Great Lakes	Burundi, Rwanda
Guinea-Bissau		
Iraq	Iraq	Iraq
Liberia	Liberia	Liberia
Chechnya	Chechnya	Chechnya
Sierra Leone	Sierra Leone	Sierra Leone
Somalia	Somalia	Somalia
		Sri Lanka
Sudan	Sudan	Sudan
Tajikistan	Tajikistan	Tajikistan

The differences between the various reports of what is and is not an emergency are small but may be significant. U.S. (especially DIA) reporting includes emergencies, such as Haiti and Sri Lanka, that involve conflict more than humanitarian issues. In particular, the early reporting of the Ethiopian/Eritrean conflict and the conflict in the Balkans by U.S. sources, along with the inclusion of Sri Lanka and Haiti, suggests that U.S. concerns and reporting tend to emphasize conflict.

At the same time, a look at UN reports not included in U.S. reporting suggests that the UN may emphasize areas where conflict spills over from one emergency into other countries. Examples of this include the Congo (a spillover from Angola) and the Great Lakes region, a spillover from the Burundi and Rwanda emergencies). This may

reflect a more regional focus on the part of the UN—which sees these emergencies in a broader context.

While table 3 does not show significant differences between U.S. and UN focus, the differences do suggest that the U.S. intelligence community's focus may be different from that of the world relief and development community. This difference in focus may result in less information being available when required.

Another way to look at the process in figure 3 is by comparing the state of world food supply and development with those countries where humanitarian emergencies are actually occurring. Figures 11 and 12 show the food-deficit countries (i.e., net food importers) defined by the World Food Program (WFP), and the least-developed countries. Again, the same figures are given for the entire world in appendix B, figures 32 and 33.

As can be seen by comparing figures 11 and 12 with the list of countries suffering from complex humanitarian emergencies, there are many more food-deficit countries than there are countries suffering from emergency conditions. While many of the complex emergencies occur in least-developed countries, a significant number do not. In addition, there is a vast swath of countries in Southwest Asia and Africa which, while they are underdeveloped, do not pose complex emergencies.

Figure 11. Food-deficit countries (Pacific region) [18]
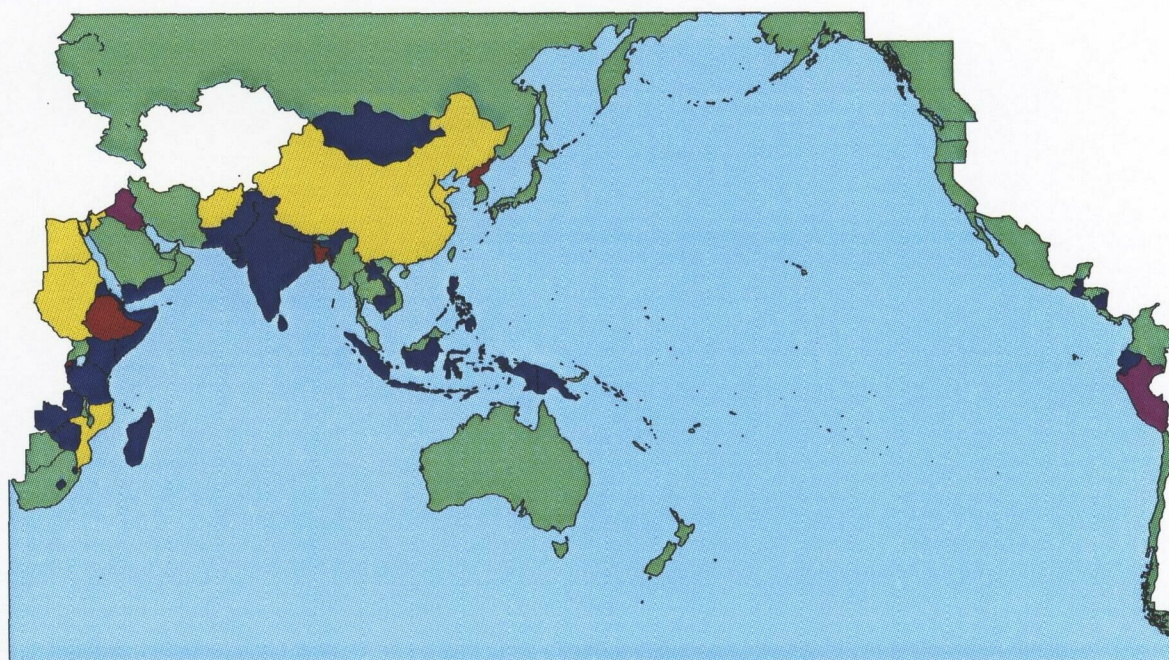
Iraq and Peru are not "low-income/food deficit" but receive more than 100,000 tons/year

<100,000 tons/year, low income/food deficit

100,000 – 300,000 tons/year, low income/food deficit

>300,000 tons/year, low income/food deficit

Figure 12. Least developed countries [18]
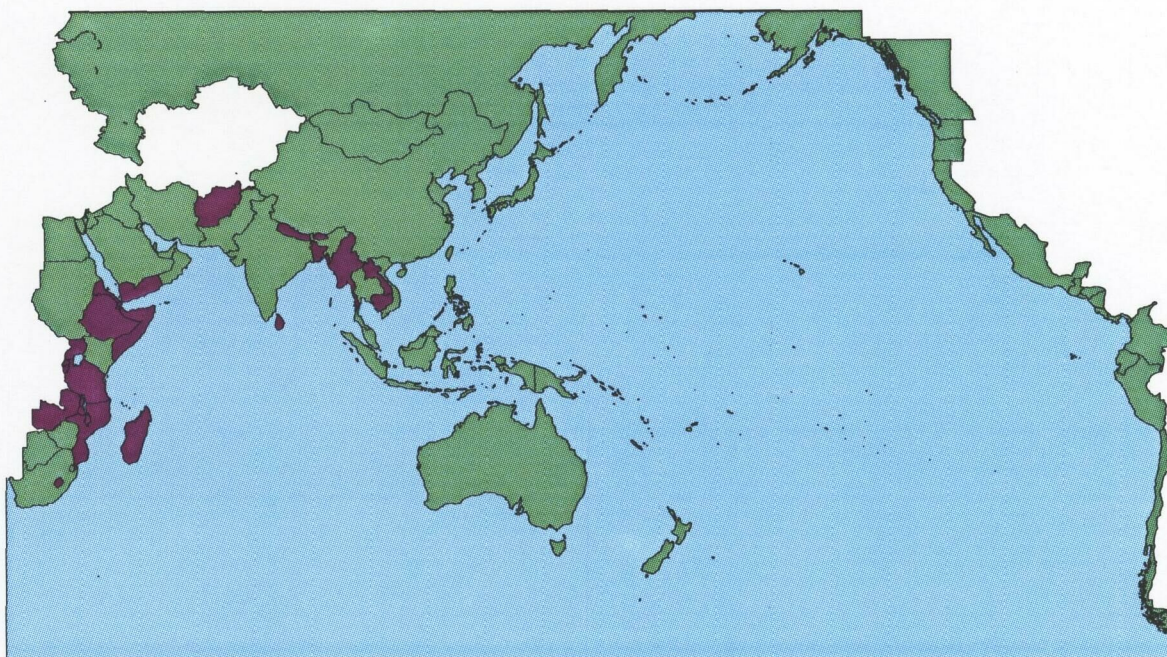
Other man-made disasters

For purposes of this paper, we divide other, man-made disasters into
two general categories: industrial accidents; and environmental,[9]
medical,[10] and ecological disasters [7].[11] Another, speculative, type
of disaster—an information disaster—will be dealt with in a separate
section. In general, ecological disasters tend to be predictable, slow-
onset disasters, while industrial accidents tend to be unpredictable,
rapid-onset disasters. For purposes of this paper, we will not go into
great detail on any of these types of disasters, and we will spend

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9. Examples include a butane gas explosion that leveled a Mexico surburb
   in 1984, the prototpyical Bhopal incident that same year, and the
   Chernyobal reactor disaster.

10. The best example of a medical disaster is the worldwide Human
    Immunodeficiency Virus (HIV) epidemic [37].

11. Examples of ecological disasters include acid rain, desertification, and
    global warming.

proportionally less time on medical and ecological disasters than we will on man-made accidents.[12]

Man-made disasters correlate with industralization more than they correlate with the usual things that make people vulnerable: poverty, conflict, or lack of development. After all, it is the presence of industrial processes, or the wealth they produce, that creates the vulnerablity to the disaster.

One method of assessing where technological disasters are more likely to occur combines the vulnerability of the populations with the *rate* of industrialization of the country involved. This assumes that the faster a country is developing, the less likely it is to have environmental, labor, and safety controls, and therefore the more likely it is to have an accident. The Union Carbide release in Bhopal, India, is an example of a technological disaster that fits into this category.

Likely candidates for technological disaster include all of the "Asian tigers" and countries experiencing high GDP growth. Figure 13 shows selected developing Asian countries with greater than 2 percent GDP growth from 1980 to 1992.

It is not inevitable that these countries *will* experience technological disaster; however, they are more likely than other countries to do so, given the pace of economic development. Nor is this the complete set of criteria for predicting potential technological disasters. One example of other forces that could work to produce these disasters may be a legacy of little or no government regulatory or environmental policy (e.g., Russia).

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12. Medical and ecological disasters have a unique set of requirments and circumstances that are beyond the scope of what we can include in this paper

Figure 13. Asian developing countries with > 2% GDP growth, 1980–92 [37]

■ Annual GDP growth > 6%

□ Annual GDP growth > 2%
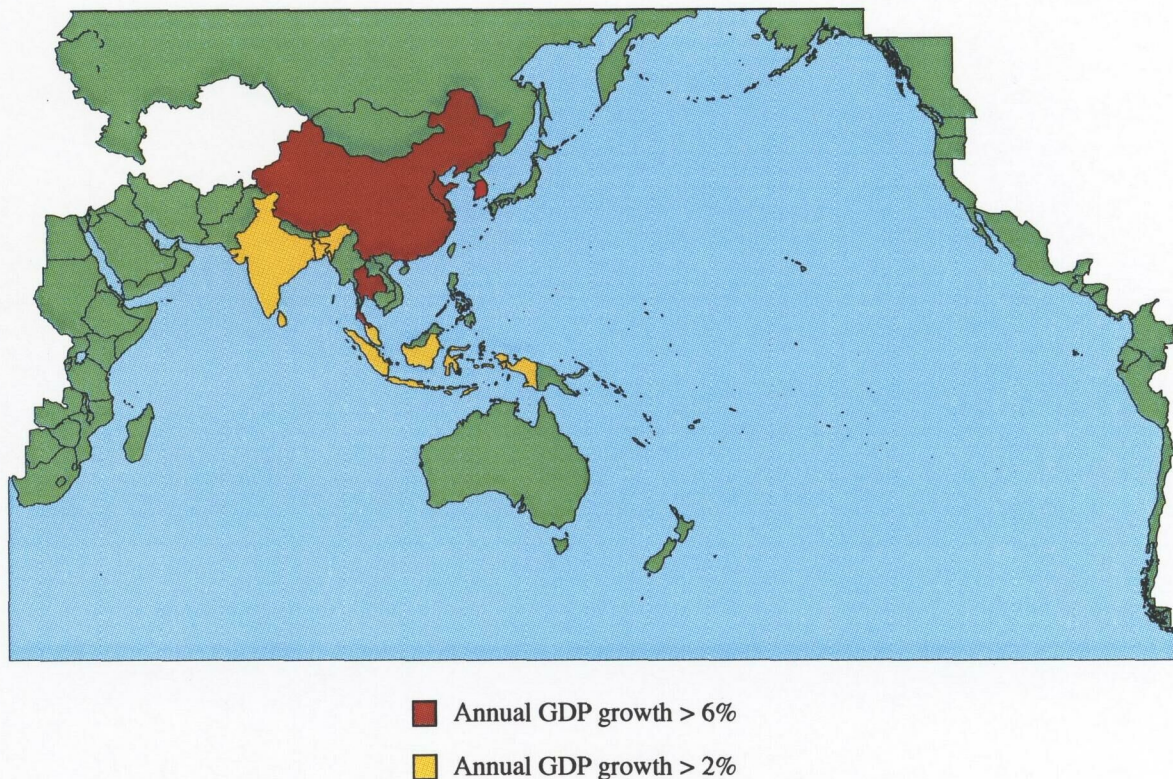
Who predicts, detects, and tracks the disasters?

Many organizations are involved with predicting, detecting, and reporting on various types of disasters. These range from the Red Cross, to the Food and Agriculture Organization of the United Nations, to the United States Geological Survey. In this section we *briefly* survey *some* of the organizations involved in this process. It is beyond the scope of the study to include every possible organization or tool available for disaster prediction or tracking.

The world relief community has embraced the Internet as a means of collecting and disseminating information about international disaster response. This provides an opportunity to get information about disasters into concerned hands quickly and efficiently. It also has the potential to result in any number of proprietary, stovepiped, information systems that track different, or overlapping, aspects of disasters.

It also can lead to a babel of datasets, data standards, and software formats that prevent any attempt to correlate or share information.

This "web" of information is difficult to disentangle. However it is important to understand the current environment of disaster tracking in order to understand the emerging capabilities of the international community to predict, detect, and respond to various types of emergencies.

UN

Many UN-affiliated organizations track disasters and humanitarian emergencies. These include the United Nations Office for Coordination of Humanitarian Affairs (UNOCHA), United Nations High Commissioner for Refugees (UNHCR), World Food Program (WFP), and United Nations Children's Fund (UNICEF). In addition to disaster information products, the UN also has databases associated with other UN functions, such as demining.

UNOCHA

UNOCHA has the most visible and substantial role of the UN organizations in tracking and coordinating humanitarian relief. UNOCHA tracks disasters through three systems [3]:

- Relief Web (www.reliefweb.int). This is the primary site for collection and dissemination of relief community information. Over 170 sources are collected or contribute to this site. Real-time appeals and information bulletins are also posted. The site also has extensive archives of natural and humanitarian emergencies. The site collects information based on postings from the organizations participating in the relief operations, primarily UNOCHA, International Federation of the Red Cross and Red Crescent (IFRC), and WFP.

- Humanitarian Early Warning System (HEWS). This is a database used by UNOCHA to identify emerging disasters and predict where various types of humanitarian emergencies will occur. It includes information generated both inside and outside the UN system. Indicators are given for 100 countries with particular focus on 20 disasters. This is one of a series of

drought, famine, and other slow-onset emergency models used by the relief community to predict where various types of relief will be needed.

- Integrated Regional Information Network (IRIN). This is a network designed to provide information specific to the complex emergency occurring in the Great Lakes region of Africa (Rwanda). It was established in 1995 and is located in Nairobi. It issues daily reports on the situation in the region. In 1998 it is planned that the network will expand to include Southern Africa, Central Asia and the Caucasus Region, and the Balkans.

Additional information on some of the specifics of these tracking systems is included in the section on telecommunications and database response.

UNHCR

UNHCR sponsors REFWORLD, a comprehensive database of refugees, minority and refugee status, migration, and international law.

WFP

As discussed in [38], the WFP vulnerability analysis and mapping (VAM) project helps local country offices to:

- Develop and geo-reference data set holdings

- Produce baseline and current vulnerability analysis

- Tie analysis results to the country strategies.

VAM is headquartered at the WFP offices in Rome, with field units in Malawi, Zambia, Ethiopia, Tanzania, and Senegal. In Ethiopia, for example, each year the WFP and FAO deploy a Joint Food Needs and Crop Production Assessment Mission. They conduct a rapid assessment of production and food needs in each region of the country.

FAO

Also part of the UN, the Food and Agriculture Organization sponsors the Global Information Early Warning System (GIEWS). GIEWS is an

Internet-based system that provides on-line analyses, databases, and electronic mailing lists. As discussed in [39], the analyses cover the following:

- Food outlook

- Food crops and shortages

- Food supply

- Weather and crops

- Special alerts.

Relief community

There are many efforts in the relief community to predict need and where disasters will occur next. These efforts can tend to be stove-piped, with little consistency between one set of data or models and the next. Currently, non-government organizations, under the general leadership of the United States Institute of Peace and others, are beginning to band together to develop a common baseline for non-government organization (NGO) mapping tools. The reasoning is that if everyone can agree on mapping software, it may be possible to standardize on database and prediction models.

Using a default standard geographical information system (GIS) mapping software suite (ARCVIEW), the NGO community is beginning to develop the *capability* to share data on flood, drought, and other data. Pilot projects include incorporating LANDSAT ERDAS data into the GIS so it can be combined with NGO data on refugee movements and food requirements. LANDSAT can be used to identify flooded areas or areas where crops have been destroyed. This, combined with famine prediction models, can allow needs assessment in advance of actual famines. In addition, NGO data derived from on-scene, local sources can often supply a level of detail and accuracy unavailable from other sources (e.g., location of small towns, condition of roads and bridges).

The GIS coordination effort is the center of information exchange between NGOs. While some progress has been made on

standardizing on a GIS system, there are still potential problems in data standardization and formatting. Various systems include:

- "Soft Risk," developed for UNICEF but sold as a commercial package by Pro.files Threat Countermeasure Group. (Reference [40] discusses this further. Additional commercial disaster management systems are discussed in [1]). UNICEF also keeps regional statistical risk data on the Internet.

- WFP's "Julia" database.

U.S. government

The U.S. government (non-Department of Defense) emergency response organizations are divided into those assisting with domestic disasters, and those associated with foreign disasters. Within the overall rubric of domestic disaster response, there is a wide range of agencies that supply prediction, tracking, and assessment data for federal, state, and local governments.

Domestic

The Federal Emergency Management Agency operates as a clearinghouse and sponsor for disaster prediction and mitigation programs within the United States. FEMA manages several programs designed to provide hazard prediction and information sharing:

- Global Emergency Management System (GEMS). This is an Internet-based database of websites related to emergency management.

- Natural Hazard Loss Estimation Methodology (HAZUS). This is a GIS-based system to provide information on earthquake hazards to buildings. It is being expanded to include a multi-hazard methodology that includes ways to estimate damage from winds and floods. It uses both the MapInfo and ArcView GIS standards.

- Capability and Hazard Identification Program (CHIP)/Integrated Emergency Management System (IEMS). This is a national database of local hazards and capabilities. Local emergency managers report on the hazards in their area,

including frequency and the impact on population. Local emergency managers also report on mitigation efforts and their capabilities to deal with disasters. CHIP replaced IEMS in 1989 and is currently used to evaluate federal assistance programs and in state and local planning.

Fundamentally, FEMA's system of hazard reporting is a "bottom up" system. State and local emergency managers are responsible for identifying and reporting on natural and technological hazards within their areas of responsibility. While this has the advantage of focusing the national program on distribution of priorities and assets, it can also result in incompatibility in the way different localities report on hazards.

Foreign

The Office of U.S. Foreign Disaster Assistance is the federal government department with the overall charter to identify, prioritize, and supply aid in the event of foreign overseas disasters. Likewise OFDA's parent organization, the United States Agency for International Development (USAID) has responsibility for funding overseas development work.

OFDA

In its role as first responder to overseas disasters, OFDA maintains a watch list of countries that may experience disaster. This list is maintained through the Bureau of Intelligence and Research of the Department of State.

USAID

USAID has financed the following information and analysis products:

- Famine Early Warning System (FEWS). This is a web-based information system designed to provide early warning of possible famine spots. It uses remote imagery and ground-based observations to predict a population's vulnerability to famine.

- AfricaLink. This is one of several efforts to get Internet connectivity to less-developed African countries.

- Gemini Application Server. This is the beginning of a dedicated Internet-based information server.

U.S. military

Intelligence community

In the case of the U.S. national intelligence community, the question is not *whether* collection and analysis occur, but the degree of attention and resources devoted to a particular problem or country. By looking at the *emphasis* that the intelligence community places on various areas and issues, it is reasonable to assume that most of the immediate attention is directed at them. Of course, intelligence community resources are being applied to a wide range of other topics and collection objectives; however, the attention of the community is focused in a particular direction.

In the case of the Defense Intelligence Agency, the Contingency Support Division lists the various hotspots currently under observation. In October 1998, those were in Africa and in the Balkans—specifically, Bosnia and Serbia/Kosovo. In the case of Africa, the analysis for support of contingency operations was directed heavily toward supporting NEOs. Likewise, the functional areas emphasized by DIA focused on counter-narcotics, counter-intelligence, and counter-proliferation. Surveys at other times led to the same general conclusions:

- The focus is on areas where conflict is occurring or may occur. Disasters, whether natural or man-made, do not generally appear on priority intelligence product lists.

- When the focus is on areas where civil unrest or fighting is occurring, the primary focus is on evacuation operations.

Joint Intelligence Center Pacific (JICPAC) has a matrixed approach toward determining which regions may require involvement of U.S. forces. This system of indications and warnings is used in determining the overall watch condition of various countries. Again, a survey of the various collection requirements, indications and warnings indicators, and the countries on the watch list suggests that the criteria observed for the DIA apply to JICPAC as well.

This is not meant to imply that this emphasis is in any way wrong. It's just that normal intelligence channels are not accustomed to dealing with the types of data involved in disaster response operations on a routine, day-to-day basis. This may affect the overall ability of the *intelligence* pipeline to respond to non-traditional missions and requirements.

Pacific region (Center for Excellence/Pacific Disaster Center)

Within each region there are regional, national, and sub-regional organizations that monitor, predict, and provide information on disaster situations. Within the Pacific region, the United States plays a significant role due to the many small nations and protectorates scattered throughout the eastern Pacific.

In this context, USCINCPAC co-sponsors the Center for Excellence in Disaster Management and Humanitarian Assistance. The center's goal is to facilitate communications between all of the different actors in humanitarian emergencies. In addition to the Center for Excellence, the Department of Defense, Deputy Assistant Secretary of Defense for Space, sponsors the Pacific Disaster Center (PDC). The Pacific Disaster Center is designed to act as a fusion center for information coming in from a wide range of sources, including producers of overhead imagery and other organizations that monitor or predict hazards.

Figure 14 shows the various relationships within the CINCPAC AOR for disaster prediction and alerts. As can be seen in the figure, there is a wide range of agencies and groups with responsibility for predicting natural and man-made hazards. To keep the diagram simple, we have included all of the organizations reporting on man-made or complex emergencies under one category.

Figure 14. Pacific warning and prediction architecture[a]

Natural Hazard Prediction

Pacific Tsunami Warning Center
  (National Atmospheric and Oceanic Administration)

International Tsunami Information Center
  (UNESCO)

Hawaii Volcano Observatory
National Earthquake Information Center
  (US Geological Survey)

National Weather Service

EROS Data Center

Imagery–GOES, RADARSAT, SPOT

Federal and state emergency management

Complex emergencies

International relief community
UN, NGOs, other countries

PEACESAT

EMWIN

Internet

Communications

Pacific Insular States

Other Pacific States

Pacific Disaster Center

CINCPAC

JICPAC

Center for Excellence

a. UNESCO: United Nations Education, Scientific and Cultural Organization; EROS:
Earth Resources Observation Systems (EROS); GOES: Geostationary Operational
Environmental Satellite; PEACESAT: Pan-Pacific Educational and Cultural Experiments
by Satellite; EMWIN: Emergency Managers' Weather Information Network.

In the figure, we divide the Pacific emergency prediction community
into four general categories:

- Producers. These are organizations whose primary role is in
  prediction, detection, and modeling of natural or man-made

hazards. For natural disasters, these include the weather services, geological survey, and various imagery producers.

- Communicators. These are the methods used to communicate the prediction information between the producers and the consumers. The primary tool is often the Internet, with satellite and broadcast systems also being used.

- Consumers. In the case of the Pacific region, the consumers of information produced from U.S. sources are:

  — United States emergency managers—both FEMA and Hawaii State Emergency Management

  — Islands in the Pacific that are part of the United States territory, such as Guam

  — Other small states in the Pacific that lack significant indigenous emergency prediction or response capability.

- Analysts. Analysts can be defined as those organizations that do not collect primary data on disasters, but rather take existing data and attempt to understand or fuse the information. The PDC is a prime example of this. The Center for Excellence and JICPAC can also play this role.

Limitations

Disaster management and prediction systems suffer from a proliferation of data but a lack of an ability to fuse the data into a meaningful picture of the overall hazard. Data standardization, in terms of both format and the meaning behind the format, is an important step toward developing an easily accessible and standardized prediction methodology. As discussed in [41], without standards, it becomes difficult to compare:

- Threats from different types of hazards—storms vs. earthquakes, for example

- Threats to different communities with different building codes and population distribution patterns

- Threats that have different impact data sets (property loss vs. people killed or injured).

Without an ability to compare across data sets, it's difficult to prioritize and compare the relative magnitudes of disasters.

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How do disasters evolve?

Timing is everything in a disaster operation. How quickly you get to the disaster site will determine whether you save trauma patients or bury them. When you arrive will determine what you will be doing: relief, rehabilitation, or recovery operations. What you are doing, of course, determines the required forces and capabilities of responding forces.

The way a disaster evolves is more important to the Navy than it is to most other services. In their response times, Navy ships occupy an intermediate position between the near-instantaneous capability of aircraft and the longer-term deployments of Army and other land-based ground forces. Ships can arrive at the scene of a disaster anywhere from days to weeks after the precipitating events occur. For some disasters, such as complex, long-term emergencies where rapid response is not needed, the Navy is rapid enough. For rapid-onset disasters, the Navy will arrive during the rebuilding and recovery phase, unless it uses fly-away assets such as the SeaBee or Marine ready brigades.

It is not easy to develop timeline information on disasters. Each type of disaster is unique, and the data are neither clear nor readily available. Furthermore, the timeline of a disaster does not come close to matching the timeline of U.S. military involvement in a crisis. The U.S. military may (and often does) arrive late and leave early in comparison to other types of responders [42].

In the following sections, we draw on both the relief literature and situation reports for different types of disasters, to attempt to understand the process of indications and warnings (I&W), response, relief, rehabilitation, and reconstruction. The information given here for

specific occurrences was obtained from the United Nations [20] and the U.S. Federal Emergency Management Agency [4].[12]

Generalized timeline

As shown in figure 2 (page 9), we divide disaster response operations into four phases:

- Monitoring, predicting, and mitigating. During this phase, the following operations may occur:

  — Mitigation and development efforts. These are designed to make the society more resistant to the effects of a disaster. In general, this is an ongoing effort and does not have a timeline associated with it—except that many mitigation efforts begin *after* a major disaster has occurred (building storm shelters in Bangladesh, for example).

  — Monitoring and predicting. Many organizations, from the U.S. Geologic Survey monitoring volcanoes, to various NGOs monitoring famine in Africa, attempt to track and predict disasters. This is a continuous process, one that transitions to warnings as a disaster becomes more likely.

  — Indications and warnings. For lack of a better term, we use the military concept of I&W. This involves recognizing the signs of an immediate disaster, and warning the affected people and government. This can be very effective in the case of slow onset or man-made disasters; months or years of warning may be available as the disaster evolves.

- Assessment and relief. Before international relief operations start, there is typically an assessment phase to determine the extent of the damage and what is required. This phase usually occurs at the same time as the initial response to the disaster. We include it here because it is often reported in the data. Relief is the "first response" phase of a disaster. It generally lasts

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12. There were too many specific events and references to cite all of the various references used in the paper.

for a few days in the case of rapid-onset disasters, but can last for months for slow-onset disasters such as famine.

- Recovery. The recovery phase starts when the immediate threat to life ends but victims are still without basic necessities such as food, water, and shelter. This phase is heavily dependent on what type of disaster has occurred and what infrastructure has been destroyed. Time periods for recovery are usually on the order of months.

- Rehabilitation. Rehabilitation is the ongoing process of restoring the society to pre-disaster levels. It consists of building a permanent infrastructure and getting the local economy going again. This phase may take years to complete.

Table 4 shows a generalized timeline for tasks during the relief and rehabilitation phases of an operation. As can be seen from the table, the relief phase generally takes on the order of a week, the recovery phase takes months, and the rehabilitation phases can go on almost indefinitely.

The timing of all of these phases depends on the vulnerability of the local population. It may take much longer for any of the phases to be completed when the population has the following characteristics:

- Poor

- Geographically isolated

- Politically, economically, or socially discriminated against.

In the following sections, we use data and reference material to suggest some timelines for various types of disasters. The data come from primary source reports (mostly the United Nations Department of Humanitarian Affairs, the International Federation of Red Cross and Red Crescent, or the International Federation of the Red Cross).

Table 4. Tasks and assets for relief response phases [43]

Phase	Task	Timeframe
Relief	Perform search-and-rescue operations	Days 1-5
	Clear rubble	Days 1-5
	Reestablish communications	Days 1-5
	Coordinate external assistance	Days 1-5
	Provide emergency shelter	Days 1-5
	Reestablish damaged infrastructure	Days 1-5
	Establish security	Days 1-5
	Perform assessment	Days 1-5
Recovery	Provide essential building materials, expertise; rebuild damaged housing	Months 1-3
	Reestablish damaged infrastructure	Months 1-3
	Make complete assessment	Months 1-3
	Coordinate external assistance	Months 1-3
	Clear rubble	Months 1-3
Reconstruction	Reestablish damaged infrastructure	Month 3-->
	Rebuild housing; establish codes	Month 3-->
	Devise contingency plans for future disaster relief	Month 3-->
	Develop material stockpiles	Month 3-->

Natural disasters—rapid onset

One of the primary effects of rapid-onset disaster is trauma injuries. These injuries need immediate attention, leading to the general concept of the "golden 48 hours" of response to these emergencies. Others have suggested that, depending on the disaster, surgical and medical care are most needed from 24 to 48 hours after the disaster [7].

Storms

Table 5 shows various timelines for tropical cyclone activity.

As we discussed in the section on the magnitude of disasters, the effects of a tropical cyclone will vary with the location it hits and the vulnerability of the population. Likewise, when a storm hits a more developed area, relief may be quick in coming; however,

rehabilitating a large metropolitan infrastructure may take considerably longer than restoring rural villages.

Table 5. Tropical cyclone timeline

Source	Predict	Assessment	Relief	Recover	Rehab.
Pacific Disaster Center (PDC)[a] [44]	72-96 hrs		2-3 weeks	1-5 years	
Cyclones (overall)[b]	24-48 hrs	2-18 days	9-30 days	2-7 months	5 years[c]

a. PDC does not distinguish between recovery and rehabilitation phases.
b. There were 15 storms, Dec 96-Sep 98, that lasted between one and two days. Not all phases could be estimated from the data available for every cyclone. The times reported represent the range of times shown in the data.
c. Assessment for China, Aug 97 typhoon.

In addition to the range of numbers shown in table 5, we can also look at several specific cases. Figure 15 shows three recent typhoons in the Pacific and the approximate number of days that elapsed during different phases of relief operations. As we have mentioned, the reporting on any individual disaster often tends to be spotty, and a comparison of different events can show inconsistencies.

However, with the above caveat in mind, we can observe the following:

- Landfall predictions range between 24 and 48 hours' warning.[13]

- The storms tend to last between 24 and 48 hours.

- It appears to take between 2 and 3 days to assess the damage and issue appeals.

- Depending on the environment, the relief period (which is often not clearly defined because most of the "casualties" are to infrastructure) tends to last a week to a month.

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13. The United States National Hurricane Center and Central Pacific Hurricane Centers make 72-hour storm track predictions four times per day. This probably represents the upper bound of times between prediction and landfall [45].

- Recovery operations, which include feeding camps and temporary shelters, last from 3 to 7 months. After the typhoon in Madagascar, food delivery flights to inaccessible areas continued for over 4 months.

While this study does not specifically examine the Navy's role in response to domestic disasters, it is also possible to use domestic U.S. disasters as a model for disasters in technologically advanced countries. The United States and its territories have been hit by several major hurricanes in recent years, including Hurricane Andrew (South Florida, 1992), Hurricane Hugo (South Carolina, 1989), Typhoon Paka (Guam, 1997), and Hurricane Georges (Caribbean, 1998).

Figure 16 shows the timeline for Typhoon Paka. In this case, a typhoon struck a territory of the United States. Guam had many of the infrastructures and facilities that would be found in any developed or advanced industrial country. As you can see in the figure, the timelines for a typhoon striking a developed country are similar to those of a less advanced one.

If the relief phase is characterized as the time spent working on assessing the damage, getting people to shelters, and clearing the main infrastructures (e.g., roads, bridges, airports), then Paka falls within the time window of 2 to 18 days shown in table 5. Likewise, the recovery operations took approximately 3 months. FEMA assessed that the overall recovery effort would take about 1 to 2 years, because the situation was made worse by the El Niño produced drought and associated fires [46].

Figure 15. Timeline for specific tropical cyclones[a]

	Vietnam November 1997	Bangladesh May 1997	Madagascar January 1997
Warning	24 hours	24 hours	
Strikes			
Relief	5 days Request assistance 30 days	2 days First survey 3 months	3 days First survey 9 days Recovery starts
Recovery	7 months		4-5 months
Rehabilitation			
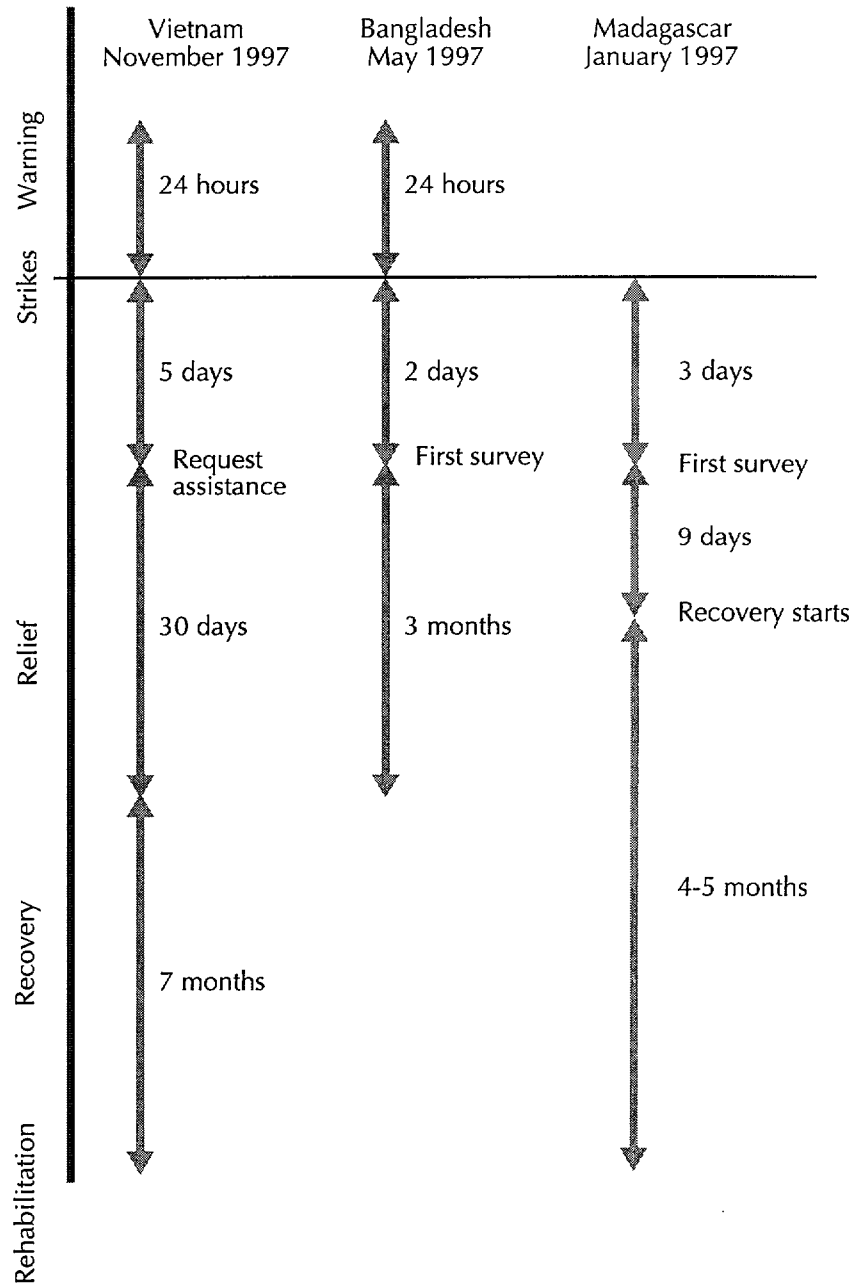
a. Blank segments on the timeline indicate that the data were not available.

Figure 16. Typhoon Paka timeline

Typhoon Paka
Guam
December 1997

Warning

Strikes

72 hours (Marshalls)

24 hours (Guam)

4 days

9 days

First relief flights arrive

3 days

Relief

Airport/port reopens

2 days

Generators arrive

6 days

Recovery

Power-line reconstruction
begins

3 months

3 months

Disaster recovery centers close

1-2 years

Rehabilitation

Full recovery
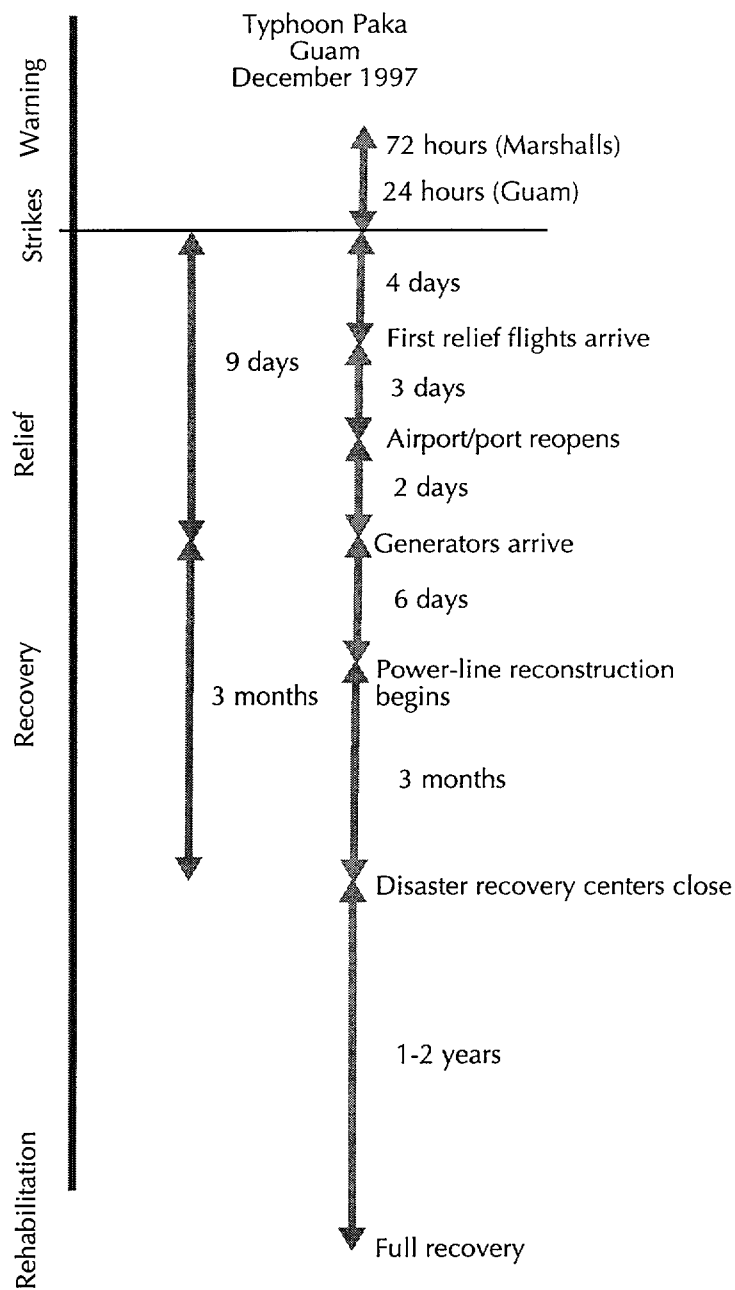
Volcanic eruptions

Volcanic eruptions are not common. Most volcanoes—thus, most volcanic eruptions— are in the Pacific region.

Like flooding, volcanic eruptions are long-term disasters that are often punctuated by rapid-onset disasters (eruptions). This means that the warning time for a volcano can be considerable, on the order of months or years. However the combination of long warning time with an unpredictable schedule for eruptions often leads to either a complex series of evacuations and returns or complacency and a sudden catastrophe. Table 6 shows the generalized timeline for volcanic activity.

Table 6.   Volcano timeline

Source	Predict[a]	Assessment	Relief	Recover	Rehab.
PDC[b] [44]	0-72 hours		2-3 weeks	1-15 years	

a. Prediction of a particular eruption.
b. PDC does not distinguish between recovery and rehabilitation phases.

Volcanoes generally give plenty of non-specific warning time. The lava dome and crater of an active volcano are tangible reminders that an eruption could, and most likely will, occur sometime in the future. However, when it comes to specific indications of an actual eruption, the timeline is much shorter. Often, there are indications of an eruption, followed by an evacuation, followed by nothing. This alertment-evacuation- return cycle appears to occur frequently for populations near the more active volcanoes. However, it also tends to correlate with a small number of casualties once a volcano actually erupts.

Figure 17 shows the timeline for the Mt. Pinatubo eruption that occurred in June and July 1991 in the Philippines. This eruption resulted in Operation Fiery Vigil, the evacuation of Clark Air Force Base. In that case, initial warning occurred as early as May 1991, and seismic activity indicating an eruption was plotted 8 days prior to the actual eruption.

Figure 17. Timeline for Mt. Pinatubo eruption, Philippines, June 1991
[25,47–48]

Warning

May 1991 — Initial warning

4 June — Seismic activity

Relief

12 June — 1st eruption

13-15 June — Ashfall, rain closes airfields
16 June — 120,000 evacuated to Manila area

18 June — Aircraft able to fly
First assessment of damage
Red Cross food distributions begin
19 June — Key roads open, power, water restoration begins

Rehabilitation

June-July — Heavy rains produce mudflows
Eruptions continue with more ash
pyroclastic flows

4 July — 472,000 total evacuees

August 1992 — 30,000 still awaiting resettlement

Present — Seasonal rains produce lahars (mudflows) near
volcano

In examining the history of Mt. Pinatubo eruptions, it becomes clear the volcanic eruptions are an inherently periodic process. In the case of Mt. Pinatubo, eruptions occurred periodically throughout June and July, causing additional evacuations and ashfalls. Pinatubo erupted again in August 1992 (resulting in evacuations but less damage), and the Mayon volcano in the Phillipines erupted in February 1993. Mayon has a history of erupting about every 8–10 years.

Another factor in increasing the effects of the volcano are the lahars, or mudflows. In the case of the Mt. Pinatubo eruption, the volcano erupted during the rainy season, resulting in periodic lahars whenever large amounts of rain fell. This cycle of mudflows has continued with each new rainy season.

Mt. Pinatubo is an example of a large volcanic event. Many of the more common events occur on islands or away from large populated areas. The recent eruptions on Montserrat (in the Caribbean) and in the Cape Verde islands are examples of such small-scale eruptions.

Figure 18 shows the timeline for recent volcanic eruptions on Montserrat, and in the Cape Verde Islands. In the case of Montserrat, the warning time was essentially indefinite. The June eruption occurred when the volcano was already at warning level 3 out of a possible 4. The key issue was evacuation—whether and where the island residents would go, and how those who chose to stay behind would be cared for.

In the case of the Cape Verde islands, the warning time was significantly shorter (1 day) for a volcano that had not erupted in over 40 years. The eruption and subsequent lava flows displaced about 5,000 initially, 1,300 permanently. The government worked to provide temporary shelter for those initially displaced, and permanently resettle those who could not return.

Volcanoes represent a particular case of a general class of disasters that are periodic and recurring. Often this means that populations "grow up" with the danger, resulting in greater complacency—thus, potentially greater vulnerability. Complacency, combined with a long history of living with the disasters, means that the disaster-relief-recovery cycle can be a prolonged process that never comes to a full resolution.

Figure 18. Timelines for June 1997 Montserrat and April 1995 Cape Verde eruptions

	Montserrat	Cape Verde
Warning	Indefinite warning Eruptions begin under eruption alert Increased activity noted 24 hrs prior to eruption	3 Apr 1995 Unusual activity Last eruption 40 years ago
Strikes	25 Jun 1997 Eruptions, pyroclastic flows 10 killed Airport closed	4 Apr 1995 Eruptions 5,000 displaced Two-thirds of island cut off from airport
Relief	August 1997 Registration for evacuation 200-500 evacuate	30 days
	October 1997 Housing rebuilds start Water, power restoration	May 1995 1,300 permanently displaced Resettlement begins
Recovery	Jan 1998 4,300 evacuated 3,500 remain	3 months
	Aug 1998 Counselling service	Feeding programs
Rehabilitation	Sep 1998 Tourism week	Disaster preparedness programs
	2.5 years Power, water restored Housing under construction restored	

Natural disasters—slow onset

We define slow-onset disasters as those that either have a long warning time or take a long time to have their full effect. The two major categories of slow-onset disasters are floods and droughts. In this section we will discuss only flooding.

Floods are ubiquitous. They occur all the time in virtually every country. Wherever people are living in low-lying areas that can receive lots of rainfall, are near rivers, or are in coastal regions, flooding is likely at one time or another.

Floods can occur as either rapid- or slow-onset disasters. Flash floods can provide virtually no warning and devastate local areas. Longer-term floods, like droughts, may result from a long-term change in the weather patterns and my have months of warning time. For example, due to the La Niña phenomenon, severe flooding was predicted up to a year in advance for much of Asia and Africa during 1998.

Table 7 shows various timelines for flooding. Several complicating factors are involved in determining the timeline during flooding:

- Rains. Often in slow-onset flooding, the time it is raining makes up a large fraction of the overall time of the flood. El Niño produced rains in Peru and elsewhere that lasted for up to 3 months. During this period, flash floods occur, infrastructure is slowly degraded, and the cost of the event continues to rise.

- Relief. Flooding relief operations are often highly variable. In Kenya many refugees in camps were isolated and affected by flood waters. Regular food deliveries were interrupted. Since the flooding occurred in the context of an already occurring complex emergency, it is difficult to determine when "rehabilitation" will occur.

- Search and rescue (SAR). SAR often occurs throughout the time of the flooding. Unlike rapid-onset emergencies, flooding often is not initiated by a well-defined event. This means that the demand for search and rescue may continue throughout the rainy period as the waters rise and people get stranded.

- Rehabilitation. Since most of the infrastructure damage is from water, the timelines for flooding and severe storms will be similar (i.e., similar rehabilitation tasks will produce similar timelines).

Table 7. Flooding timeline[a]

Source	Predict	Assessment	Relief	Recover	Rehab.
PDC[b] [44] (Local, or flash, flooding)	24 hrs		72–96 hrs	6–12 months	
Flash floods[c]	days	1 week	1 month	6 months	1 year
Slow-onset flooding[d]	1–3 months	days to months	3–10 months	1 year	

a. We examined 20 flood events for 1997 and 1998. Numbers represent a generalized characterization for the floods examined, not precise times.

b. This is for a localized, flash flood condition common to Hawaii. PDC also does not distinguish between recovery and rehabilitation phases.

c. Flash floods are defined as floods occurring with little warning and doing most of their damage through moving (as opposed to standing) water.

d. Slow-onset flooding will often be characterized by a long period of rains and flash flooding. We include this in the assessment period.

Timelines for flash flooding tend to be similar to those for storm events, producing similar damage and difficulties, while slow-onset flooding timelines tend to be similar to those of a drought.

Figure 19 shows some specific timelines for recent flooding events. The last two years (1997 and 1998) have been particularly well suited for flooding given the occurrence of the El Niño and La Niña phenomena. The extra-heavy rains that started in the fall of last year were the direct result of the sea surface changes brought on by this effect.

In the flood in Pakistan, flash floods and landslides generated by heavy rains necessitated emergency relief operations. There was little warning: the rains surprised local governments and communities.

In the case of Peru and the Horn of Africa (Kenya, Somalia, and Ethiopia) the rains were directly attributable to El Niño. Therefore, prediction times for flooding associated with El Niño are on the order of the time lead for sea-surface models, 1 to 3 months. This also meant that the rains, which coincided with the normal rainy season, took place over a period of 3 to 6 months. During that time, infrastructure was damaged and destroyed, resulting in the need for special relief operations.

Figure 19. Recent flooding timelines

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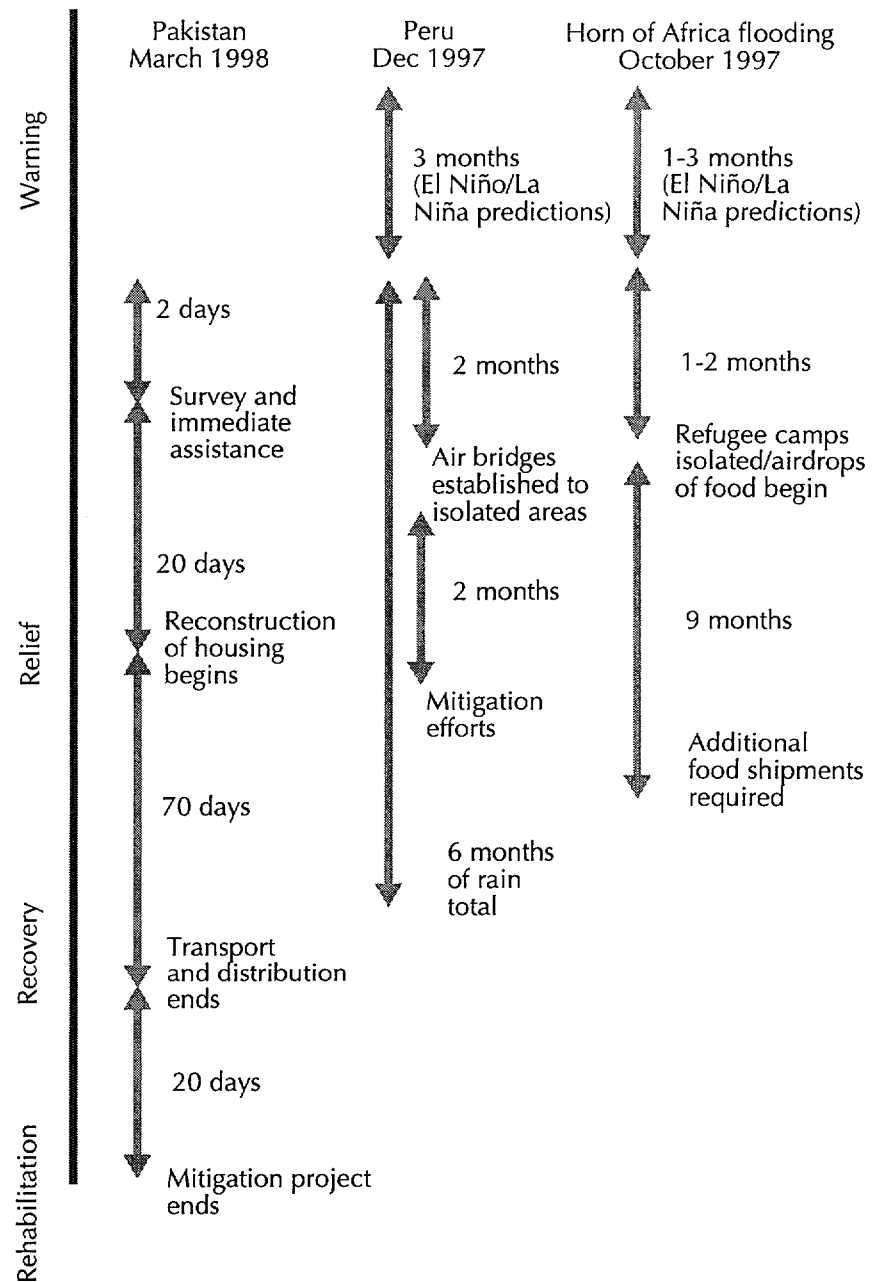
In the case of Kenya, refugee camps in the north of the country were effectively isolated from the normal relief supplies. The World Food Program began a large airlift effort, augmented by the United States through JTF Noble Response, to keep food supplies flowing to isolated camps. Because of the impoverished economies and presence of conflict-related refugees, it becomes difficult to determine when flood-related relief operations end and normal relief operations resume.

Man-made disasters

Man-made disasters are the counterpoint to natural disasters: they come about wholly through the actions of humans, but do not involve significant conflict. Some refer to these as technological disasters, to reflect the fact that they are often the result of a breakdown in a technological system. A distinction is also often made between technological disasters and ecological disasters [6].

Man-made disasters include [41]:[14]

- Fires.

- Industrial accidents such as hazardous materials releases or nuclear accidents.

- Environmental disasters. These include ecological disasters, which, like acid rain, can be extremely slow in arising and very difficult to mitigate once they are noticed [6].

- Large-scale accidents (e.g., dam bursts , shipwrecks).

- Network failures (e.g., power, water, telecommunications).

Man-made hazards vary greatly. Some can occur instantly and without warning (dam failures, nuclear accidents, network failures) while others can take years or decades to unfold (long-term ecological

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14. Other hazards, such as terrorism, civil unrest, and ballistic missile attack, can also be included as man-made disasters. These are not included in our definition of either "disasters" or "complex emergencies."

disasters such as global warming). Therefore, we divide man-made disasters into slow-onset and rapid-onset disasters. This allows us to separate the very different timelines for slow-onset ecological disasters from other types of man-made disasters where onset is rapid, and often comes without any warning.

We also divide the disasters into physical and *psychological* hazards. An example of a psychological disaster was the space shuttle *Challenger* explosion. While only a few were killed, its overall effect was magnified by the status of those killed and the attention of the press. Other examples of psychological hazards would include airline and other transportation disasters or structural disasters (building, bridge collapse). These hazards can often result in public and political pressure to conduct rescue or recovery operations well beyond their practically useful time (recovery of bodies from overwater airline disasters, for example). We do not address psychological hazards in this paper.

Given the broad span of disasters that occupy this category, it is not possible to cover all types of man-made disasters in this paper. Instead, we focus on industrial accidents involving hazardous materials. We chose this particular category because:

- Industrial accidents are common.

- They can have significant effects, both in terms of casualties and economically.

- They often occur in coastal areas.

- Their causes and effects are substantially different from those of other types of natural disasters.

Table 8 gives the general timeline for a man-made disaster.

Table 8. Man-made disaster timeline

Source	Predict	Assessment	Relief	Recover	Rehab.
PDC [44]	Indefinite		72-96 hrs	1-5 years	

In a hazardous materials release, there is an immediate period when medical "first responder" personnel arrive, identify the agent, and begin evacuation, decontamination, and treatment of the victims. This phase usually lasts one or two days, depending on the extent of the release and the nature of the agent.
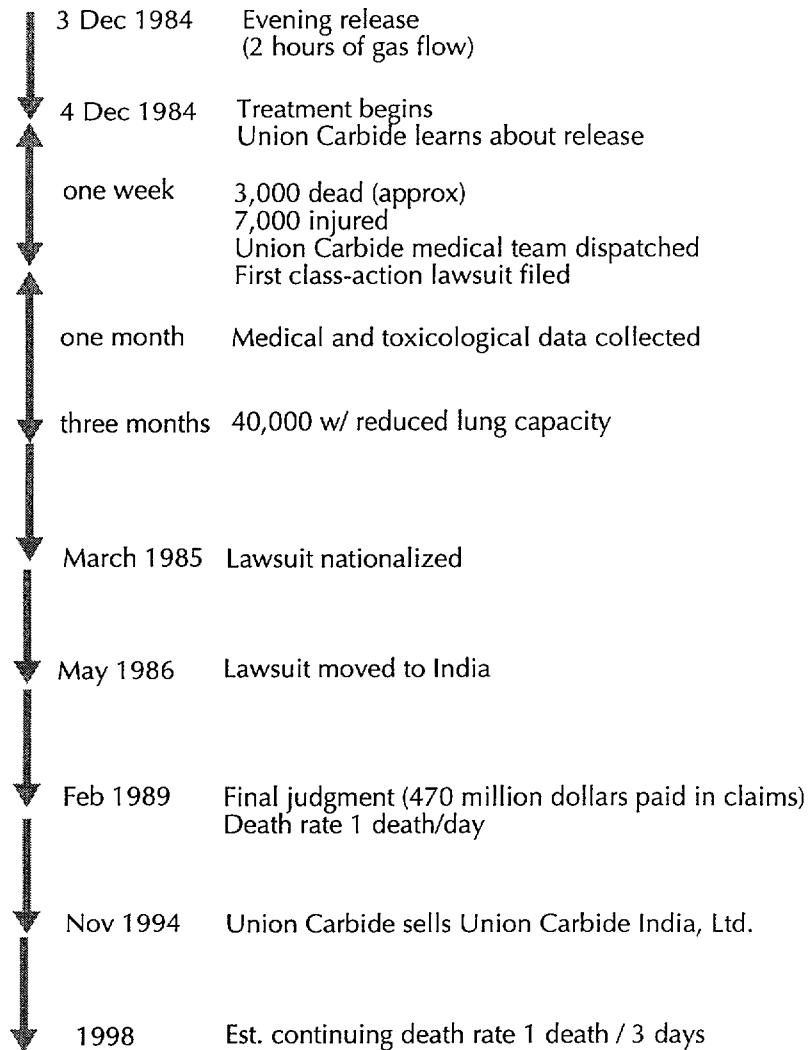
After the first response, there is a long period of recovery and rehabilitation. During this time period, the wider area is decontaminated, long-term health consequences of exposure to the agent are treated, and the process of sorting out what happened and who is responsible begins. This period can take many years, and may ultimately last beyond the lifetime of the victims.

On the night of 3 December 1984, workers attempting to flush chemical lines with water at a Union Carbide pesticide plant in Bhopal, India, dumped water into a methyl iso-cynate tank, triggering a reaction and a release of large quantities of toxic gas. Figure 20 illustrates the timeline for events following the gas release.

While the incident should have been a (relatively) straightforward mass-casualty event, lack of information and community preparedness extended the period of initial assessment out over a period of weeks. It was not until almost a week into the disaster that epidemiological and other information about the chemical was widely available. Local physicians did not know what was causing the casualties, and treatment was haphazard and mostly directed toward decontamination and treatment of symptoms.

The medical and relief problems were complicated by the simultaneous filing of numerous lawsuits by American lawyers who arrived on the scene. When the Chairman of Union Carbide arrived in India to direct relief efforts, he was immediately arrested and deported. This was the beginning of a long and acrimonious relationship between the Indian government and Union Carbide. The adversary relationship that was set up between everyone involved colored the rest of the relief and recovery efforts, and has obscured much of what actually occurred.

Figure 20. Timeline of the Bhopal chemical disaster [49–50][a]

3 Dec 1984	Evening release (2 hours of gas flow)
4 Dec 1984	Treatment begins Union Carbide learns about release
one week	3,000 dead (approx) 7,000 injured Union Carbide medical team dispatched First class-action lawsuit filed
one month	Medical and toxicological data collected
three months	40,000 w/ reduced lung capacity
March 1985	Lawsuit nationalized
May 1986	Lawsuit moved to India
Feb 1989	Final judgment (470 million dollars paid in claims) Death rate 1 death/day
Nov 1994	Union Carbide sells Union Carbide India, Ltd.
1998	Est. continuing death rate 1 death / 3 days

a. The long-term effects of momentary exposure to toxic chemicals are still the subject of controversy, particularly in a case like Bhopal that has been heavily litigated. Estimates for deaths/unit time are from higher-end casualty estimates. Casualty estimates range from 3,800 (Union Carbide) to 8,000 (community advocates). Union Carbide claims that there is no indication that the exposure to methyl iso-cynate caused any long-term health effects.

Eventually all lawsuits were consolidated into an Indian government lawsuit which ground its way through U.S. and Indian courts. The lawsuit was finally adjudicated in 1989, but the case was re-opened soon afterwards by a new Indian government.

This suggests that there are three timelines operating in a hazardous materials event:

- "First response": decontamination, evacuation, treatment of casualties

- "Second response": follow-on decontamination of the wider area, long-term medical treatment and tracking

- "Political response": determination of what caused the event, who was responsible, and how they should be held accountable.

In the case of Bhopal the "political response"—in particular, the attempts to assign blame and hold individuals responsible— occasionally dominated over relief and rehabilitation efforts.

Complex emergencies

We divide complex emergencies into two types of operations: peacemaking and peace enforcement. In peacemaking operations, the emphasis is on diplomacy. Military forces are used to facilitate, and sometimes intimidate, the opposing sides to come to agreement. In peace enforcement operations, military forces are used to ensure that the local environment is secure, either directly in support of peace operations, or indirectly in support of humanitarian operations.

In this section, we cover the generalized timelines for different types of peacemaking and peace enforcement operations. For additional detail on the operations themselves, see the section, "What Response is Required."

Peacemaking

In the aggregate, negotiations for peacemaking operations can take a significant amount of time. Although individual negotiations may take days or weeks, the entire process may take years.

In this paper, we single out three recent events that required negotiation: the crisis in Haiti, operations in Somalia, and the U.S.-Soviet summit in Malta harbor. A detailed description of each of these events is provided in the next section. Here we provide an overview of the timelines for the negotiations that occurred during each event. In the next section, we discuss the overall timeline for the operations.

Haiti

Figure 21 shows a generalized timeline for negotiations that occurred after General Raul Cedras overthrew the democratically elected government of Haiti in September 1991. For additional details about each phase and event shown in this figure, see the section, "What Response is Required: Complex Emergencies: Peacekeeping: Haiti."

During this time period, the Organization of American States (OAS), the United Nations, and individual nations, such as the United States, attempted to negotiate with the Cedras military government to try and restore democracy to Haiti. The entire process took almost 3 years, involved four different agreements (three of which were abrogated by the military government), and had periods of negotiations that lasted from a week (the Governor's Island agreement negotiations) to a year.
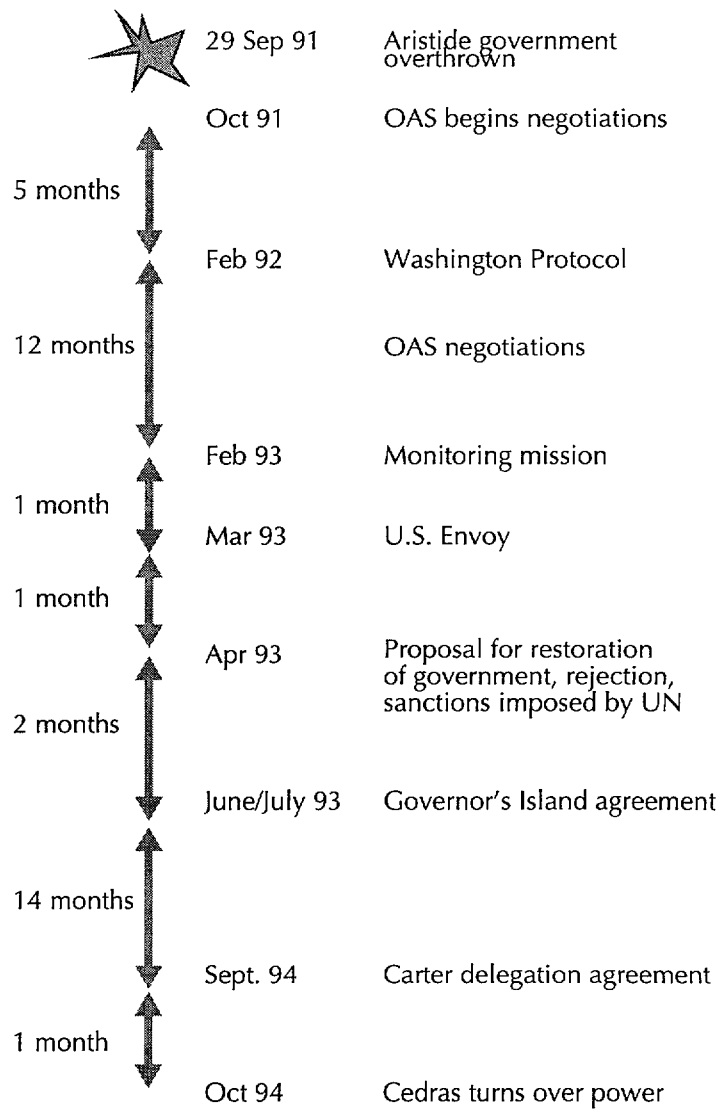
There were three primary periods of negotiations between the Cedras government and the UN and OAS. Table 9 shows the times for these negotiations. As can be seen from the table, negotiations took anywhere from 2 days to 5 months to complete.

Table 9. Haiti negotiating periods[a]

Period	Time interval for negotiations
Washington Protocol	5 months
Governor's Island Agreement	7 days
Carter-Cedras Accord	2 days

a. For additional information on these agreements see the Haiti discussion in the section, "What Response is Required: Complex Emergencies: Peacemaking: Haiti."

Figure 21. Haiti diplomatic timetable[a]

	29 Sep 91	Aristide government overthrown
	Oct 91	OAS begins negotiations
5 months		
	Feb 92	Washington Protocol
12 months		OAS negotiations
	Feb 93	Monitoring mission
1 month	Mar 93	U.S. Envoy
1 month		
	Apr 93	Proposal for restoration of government, rejection, sanctions imposed by UN
2 months		
	June/July 93	Governor's Island agreement
14 months		
	Sept. 94	Carter delegation agreement
1 month		
	Oct 94	Cedras turns over power

a. OAS: Organization of American States.

Somalia

As with Haiti, the timeline for negotiations in Somalia occupies a large fraction of the time that the attention of the U.S. government was focused on the country. U.S. envoy Robert Oakley and UNITAF commander Gen. Johnson spent large amounts of time negotiating

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with various factions and warlords to attempt to restore order and disarm the warring factions.

Between 1991 and 1995 there were 17 national-level and 20 local-level attempts to reconcile the warring parties in Somalia. Figure 22 shows a timeline for some of the negotiations that occurred during the periods of UNOSOM I and UNOSOM II. Because there were so many, and they occurred almost continuously during the time period when U.S. or UN forces were ashore, we ignore many of the smaller conferences and informal meetings. Often the U.S. representative, Amb. Oakley, or representatives from UNITAF would precede U.S. forces into an area in order to meet with clan leaders and reassure them of UNITAF's peaceful intentions.

In most of the national peace talks, up to 15 factions participated, but the principal conflict was between General Aidid's Somali National Army (SNA) and a variety of former government and clan factions [52].

The major events shown in figure 22 include:

- Djibouti I and II, national peace talks, held in Djibouti and sponsored by Djibouti, Italy, Egypt, and Saudi Arabia.

- Prior to the establishment of UNOSOM and UNITAF, the UN-held consultations with the principal factions in Mogadishu.

- The agreement reached by Amb. Oakley and Gen. Johnson as part of Operation Restore Hope.

- A variety of talks aimed at getting all of the various warring factions to reconcile and disarm. These talks began in January 1993 (during UNITAF) and continued on until UNOSOM II was disestablished.

Malta

We include the Malta summit in our discussion of diplomatic operations because it is an example of afloat naval forces supporting diplomacy directly. Details of the Malta summit can be found in the section: "What response is required?: Complex emergencies: Peacemaking: Malta."

Figure 22. Somalia diplomatic timeline [51–52]

	May, Jul 91	Djibouti I, Djibouti II
	3 Mar 92	Ceasefire negotiated between warring factions
	27-28 Mar 92	Agreements signed to allow ceasefire monitoring
	Apr 92	UNOSOM I established UN begins consultations with warring parties
	June 92	Consultations end, parties agree to UN monitors
	Oct 92	Seychelles consultations
	Oct 92	Somali factions disagree on UN role, limit UN effectiveness
Continuous negotiations at strategic/ unit levels	**7-8 Dec 92**	U.S. envoy (Robert Oakley) negotiates with factions
	9 Dec 92	Multi-national, U.S. led, force intervenes (UNITAF)
	11 Dec 92	Gen. Johnson, Oakley negotiate with clan leaders on security issues
	Jan 93	Addis Abba peace talks (disarmament)
	Feb 93	UNITAF declares a secure environment
	15 Mar 93	Addis Abba peace talks begin
	27 Mar 93	Addis Abba talks end
	Dec 93	Fourth Humanitarian Conf./Addis informals
	Jan 94	Cairo peace conference
	Mar 94	Declaration on National Reconciliation signed by Aidid: pledges ceasefire/ disarmament
	Apr-Sep 94	Reconciliation discussions, "all Hawiye" conference

The 2-day Malta summit took place onboard U.S. and Soviet cruisers (and a Soviet cruise ship) from 2 to 3 December, 1989, between President Bush and Chairman Gorbachev.

General

From examining a range of peacemaking operations, we observe:

- Most *specific* diplomatic events, consultations, peace conferences, and other gatherings last between a day and a week.

- In any particular conflict, especially those in multi-faction civil wars, diplomatic operations can be nearly continuous, with multiple events occurring in a year.

- Because U.S. forces are often introduced at important times during a prolonged conflict, naval ships may be available as venues for some of the more important negotiations.

Peace enforcement

By "peace enforcement" we mean operations which have a significant security component. This can involve defensive security operations (e.g., escorting convoys in Somalia), an offensive element(e.g., disarmament in Somalia and Haiti), or a combination of both. We exclude purely humanitarian operations that occur in response to social, economic, or natural disasters.

Haiti

The U.S. intervention in Haiti in September 1994 does not easily fit into any category. As we saw in the previous section on complex emergencies, the United Nations does not formally define Haiti as a complex emergency. Initially it was difficult to get non-government actors to become involved in Haiti because it was not considered a humanitarian crisis [53].[15] However, the U.S. government does define Haiti as a complex emergency, and the various U.S./UN involvements in

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15. There are many different perspectives on how to catalog Haiti. For a summary, see [53–54].

Haiti over the past 7 years have many of the characteristics of a complex emergency.

Haiti is also a good example of one type of intervention that required a security (air assault) operation, and involved actions taken by sea-based forces against a rudimentary military force.

One reason that Haiti is a good example of a complex emergency is that is has a long and complex history of interactions with colonial powers. This is also the case for many developing African countries that experience internal revolutions, violence, and humanitarian suffering. Other examples of countries whose internal disorder can be traced back far into their (often colonial) history include:
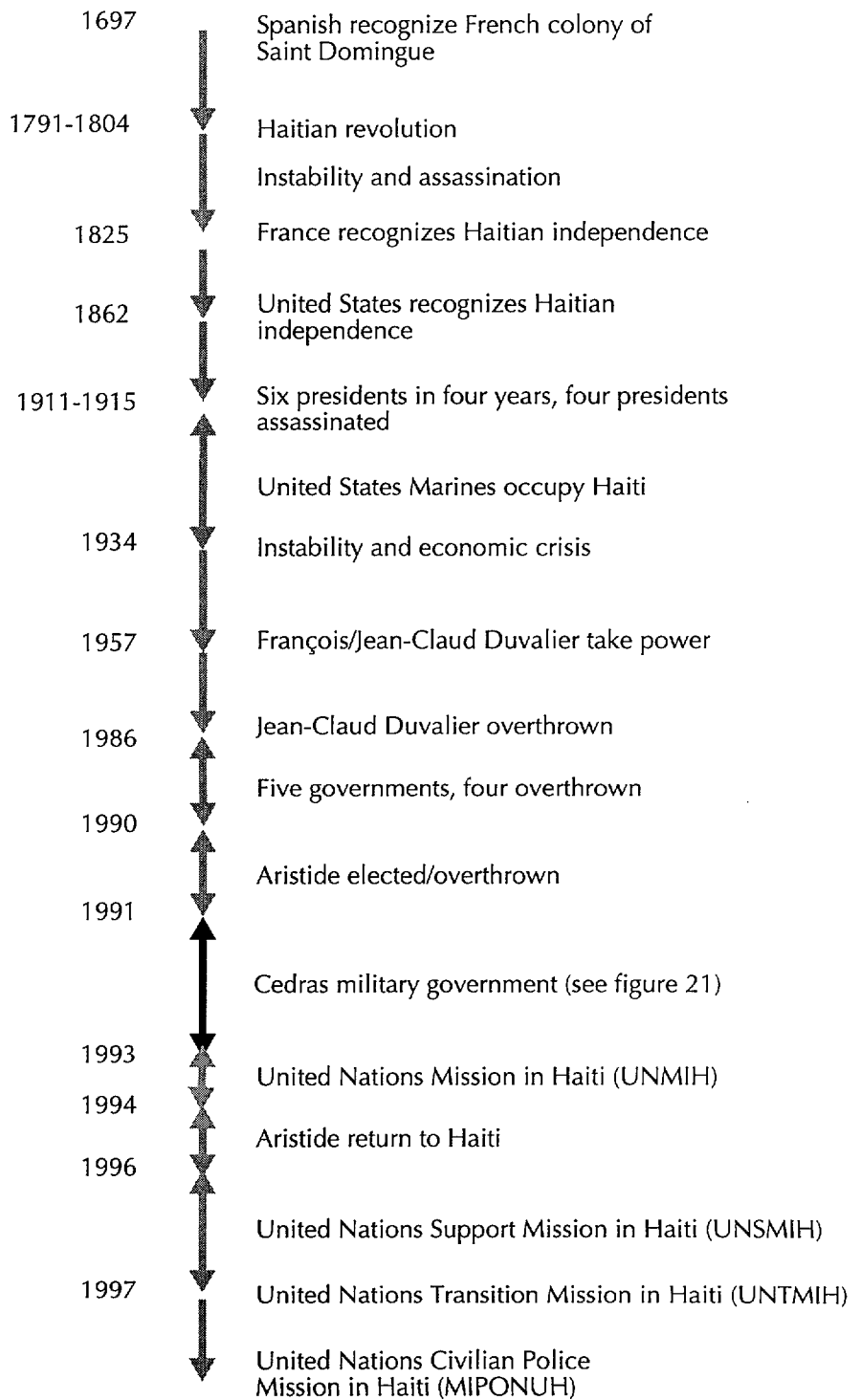
- Congo

- Central African Republic

- Liberia

- Albania/Balkans

- Angola

- Afghanistan.

In any of these cases, the current crisis can be traced to both a time and an event, as well as a series of events that occurred over many years, before eventually resulting in the current situation.

Figure 23 shows the timeline for Haiti, starting with Haiti's independence from France in 1804. Only once or twice in its entire history has Haiti had a peaceful and stable economy or government, unless some outside force (such as the U.S. Marines or United Nations) was occupying or assisting the country.

After the U.S.-led intervention in Haiti, a series of United Nations missions to Haiti was established. The first three of these missions had military forces associated with them. The current one, MIPONUH, is a civilian police mission to assist the Haiti national police force and help professionalize it.

Figure 23. Haiti timeline [53–54]

1697	Spanish recognize French colony of Saint Domingue
1791-1804	Haitian revolution
	Instability and assassination
1825	France recognizes Haitian independence
1862	United States recognizes Haitian independence
1911-1915	Six presidents in four years, four presidents assassinated
	United States Marines occupy Haiti
1934	Instability and economic crisis
1957	François/Jean-Claud Duvalier take power
1986	Jean-Claud Duvalier overthrown
	Five governments, four overthrown
1990	
	Aristide elected/overthrown
1991	
	Cedras military government (see figure 21)
1993	
	United Nations Mission in Haiti (UNMIH)
1994	
	Aristide return to Haiti
1996	
	United Nations Support Mission in Haiti (UNSMIH)
1997	United Nations Transition Mission in Haiti (UNTMIH)
	United Nations Civilian Police Mission in Haiti (MIPONUH)

The historical timeline for Haiti makes a couple of important points:

- In many countries with complex emergencies, instability is nothing new.

- Organizations may have intervened in the past, and in fact may still be around when the U.S. military becomes involved. In the case of Haiti it was the U.S. Marine Corps which had previously occupied the country during a period of instability.

- Someone will be left behind, often the United Nations or non-government organizations.

Looking at the figure, there appears to be no one set of time intervals that is characteristic of the internal strife within Haiti. Haiti has been in internal conflict during most of its history. Within that historical timeline, there are periods of greater and less instability. For example, during the periods 1911–15, 1950–57, and 1986–90, presidents turned over almost as fast as they could be elected and killed. (In fact, the first "emperor" of Haiti ruled for only one year before being killed by rebels). Table 10 lists some of the time intervals between periods of turbulence and the periods during which turbulence has occurred.

Table 10. Time scales for internal strife in Haiti[a] (months)

	348	48	5	.07
	228	48	1	.03
3,600	180	12	2	
	84	12	.23	

a. The time intervals in the last column are from figure 21; all the other columns are from figure 23.

In examining the information in table 10 and the figures, we can draw an analogy with the physical concept of "length scale."[16] In a system where there is no particular length scale, it becomes difficult to develop an "average" or typical length that corresponds to the object.

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For Haiti, we have nothing like the rigor or consistency in the data required for a determination of an actual time scale, much less a relationship between the various time intervals. However, the variation in the time intervals of the crisis are striking. They range from virtually the entire history of the country to the day or two during September 1994 when Cedras agreed to step down.

This lack of a characteristic time interval may be an important determinant in many complex emergencies. Such emergencies often have the following characteristics:

- They originate in the deep history of the country.

- Data on whether and when they occur often differ according to who is reacting: relief workers, the international community, or the U.S. military.

- How long a particular phase of the crisis lasts is determined by many complex, interrelated actions.

- The same types of crises (revolutions, repression, economic collapse) often reoccur with striking regularity throughout the country's history.

Somalia

Unlike those in Haiti, Somalia's humanitarian and security crises were clearly linked. Figure 24 shows the timeline for UN and U.S. involvement in Somalia. U.S. involvement in Somalia began in 1992 in response to a large crisis in food distribution. As international relief flights began delivering aid into Mogadishu, the United States and UN quickly realized that food could not be distributed unless the country was at peace. At that point the UN authorized, and the U.S. responded with, a military task force designed to allow relief activities to occur unmolested.

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16. The idea of a relationship between various measured lengths for an object which are characterized by a functional relationship arises from several areas of physics. When the functional relationship is a power law, the object is said to be "fractal" [55]. As is the case in the time scale discussed here, fractal objects appear to have no one characteristic scale.

Figure 24. UNITAF/UNOSOM I, II timeline [from 51–61]

24 Apr 92	UNOSOM I established
Jul 92	Relief flights begin
Sep 92	UNOSOM I strengthened, Pakistani forces sent to Somalia
3 Dec 92	UN authorizes intervention
9 Dec 92	Multi-national, U.S.-led, force intervenes (UNITAF/Operation Restore Hope)
4 Feb 93	Secure environment declared by UNITAF
Mar 93	UNOSOM I ends UNOSOM II begins
May 93	Control of military operations transferred from UNITAF to UNOSOM II
Jun 93	Aidid's faction attacks UNOSOM troops—UNOSOM attempts to capture Aidid
Oct 93	Ranger raid to capture Aidid aids, U.S. troops killed
Mar 94	Aidid and others repudiate violence and commit to a ceasefire and disarmament (Nairobi Declaration)
Feb 95	Agreement for power sharing, democratic elections, and peaceful dispute resolution
Mar 95	UNOSOM II ends

As was the case with Haiti, the origins of conflict in Somalia go back to the earliest days of the country. Originally composed of a nomadic, pastoral clan system, Somali clans formed the basis of power in the country. In the 1880s, the Italians, French, and British divided the region; many of the divisions crossed tribal and clan boundaries. After World War II, Britain controlled the north (Somaliland) and Italy retained control of the south. This was the case until a unified republic was declared on July 1, 1960 [62].

Somalia was democratic from 1960 to 1969. Clan rivalries were still strong, however—they were just played out within the democratic and governmental systems. The presence of ethnic Somalis in Kenya and Djibouti put pressure on the government to regain these areas as well. Lacking help from the west, Somalia became a Soviet client state in 1968. The Somali president was assassinated in October 1969 [62].

The assassination was the first step in the takeover of Somalia by MGen. Mohamed Siad Barre. He set up an authoritarian regime based on his own clan. Barre eventually went to war with Ethiopia in 1977, causing the Soviets to change sides and Barre to kick the Soviets out of Ethiopia. By 1978 the Somali army, lacking the Soviet support and equipment given to Ethiopia, was routed. Worse yet, the Somali economy collapsed at the same time [62].

After his defeat by the Ethiopians, Barre turned to the United States, which helped during the 1980s with a variety of aid programs. However continued dominance by Barre's clan, and a growing insurgency, led to a civil war in May 1988. By 1991 fighting had progressed to the point that the United States conducted a NEO to evacuate the U.S. embassy [26]. In May 1992 Siad Barre's army was destroyed by the army of his principal rival, General Mohamed Fara Aidid.[17] Barre fled the country [62].

Once Barre was gone, the rebels fell into squabbling among themselves. The resulting fighting caused massive destruction of infrastructure and civilian casualties. In addition to direct casualties from the fighting during and after the civil war, civilians were starving because

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17. Alternate spelling is "Aideed."

relief supplies could not reach them in the face of looting, stealing, and extortion by criminal and clan forces [62].

General

There are similarities between the timelines for Haiti and Somalia:

- They were former colonies of European powers.

- After independence they had a history of either repression or conflict.

- The emergencies were as much a result of political infighting and repression between sub-national groups as of actual economic and social collapse.

While Haiti has had a longer time span since independence than Somalia (200 years vs. 30 for Somalia), the sequence in both cases is similar: repression, involvement by outside powers (U.S. and Soviet Union), and eventual civil war and political turmoil.

In fact, this cycle is similar in many of the complex emergencies listed by the United Nations. Examples include:

- Angola. The Angolan insurrection against Portugal began in 1961. During the war that followed, several rebel movements fought for Angolan independence. The war against Portugal continued to 1975, when Angola became independent. However, as in Somalia, rivalry between various factions quickly led to civil war. The United States and the Soviet Union (through Cuba) took sides in the war, and eventually even South Africa became involved. In 1988 a peace treaty was signed that resulted in the Cubans leaving entirely by 1991. While a cease-fire was called between the various groups, fighting broke out again and lasted until a new peace agreement was signed in 1994. Lack of cooperation continued well into 1997 [59–60]. Angola has been the subject of four UN peacekeeping operations (UNAVEM I, II, III, and MONUA) since 1989.[18] All

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18. UNAVEM: UN Angola Verification Mission. MONUA: UN Observer Mission in Angola.

the various sides have continued to position themselves, hoping to gain the advantage even in the face of peace accords and UN observers. This has led to a tense and difficult humanitarian situation.

- Central African Republic. This area of Africa was colonized by the French and Belgians during the 1880s. An independence movement began in 1941, culminating with a coup by French-backed Lt. Jean-Bedel Bokassa in 1966. In 1979, Bokassa was overthrown; then another coup occurred in 1981. Since April 1996, there have been three mutinies by the armed forces in the CAR. In January 1997, the Bangui agreement was signed. It formed a unity government, promised amnesty, and called for disarming the various factions and militias [19–20].

- Great Lakes. In other areas, such as the Great Lakes region of Africa (Burundi, Rwanda, Zaire, Tanzania, and Uganda), the source of conflict is not civil war but ethnic and cultural conflict.

The origins and trajectory of these conflicts suggest the following:

- The countries tend to cycle through periods of repression, violence, and civil war. When the conflict or repression becomes extreme enough to disrupt basic economic or relief functioning, a complex emergency arises.

- The conflicts are long-term problems. The problems arise from deeply rooted historical divisions, often in a colonial legacy.

- There is no particular time scale that intervening forces can expect. Even within an operation, the time scales of issues can vary widely. In other words, it is difficult to predict how long a particular problem will take to resolve, particularly when that problem involves civil or ethnic conflict. It is likely, however, that there will be times when the conflict cycles between more and less severe. It is during the times when the conflict "cools down" that intervening forces have a chance to disengage.

- If many of the failed states and civil wars that result in complex emergencies arise from a legacy of colonialism, then the CINC-PAC AOR, with a more benign European colonial past than

Africa, may be less likely to have the virulent, repetitive crises that are currently seen in Africa. There are, of course, exceptions, such as Afghanistan, East Timor, and Sri Lanka.

What response is required?

As we discussed in the introduction, we divide natural disasters by their speed of onset. The response requirements are substantially different in each case. Rapid-onset natural disasters leave little room for mitigation efforts during the disaster. Relief forces may need to arrive hours or days after the disaster in order to provide immediate trauma and medical assistance.

Slow-onset disasters may allow for mitigation efforts to take place as the disaster is occurring (for example, shoring up dikes during floods). They also tend to have fewer trauma casualties and to be spread over wider geographic areas. Complex emergencies, with their threat of violence and large numbers affected, have yet another set of requirements.

In the following sections, we discuss the effects of all these types of disasters, in several ways. There are the *general* effects which represent the general requirements associated with that particular type of disaster. We divide the general requirements for disaster relief into medical, infrastructure, and economic/social.

There are unique aspects that can be loosely associated with a particular type of disaster, though they may also occur in other disasters. We discuss these unique or unusual attributes in this subsection, under the disaster they are commonly associated with. In most cases, these "unique" attributes will primarily apply to technologically advanced areas affected by the disaster. Finally we provide examples of requirements, gathered from several particular examples of the type of disaster.

Natural disasters—rapid onset

With rapid-onset disasters, the effects are often limited and the response required can usually be met by the indigenous government.

Referring to figure 3, by the time all of the other various responders have arrived and begun their work, the tasks that are left for the U.S. military may be few and specialized. There may be little that afloat naval units can do. Examples where significant military response may help include:

- Very large disasters. Examples are large-scale disasters in a highly developed and populous country (e.g., the Kobe earthquake), massive disasters in an impoverished country (e.g., the 1991 cyclone in Bangladesh that resulted in Operation Sea Angel), and disasters that overwhelm an entire country or region.

- Remote or inaccessible disasters. Part of the difficulty in the 1993 Bangladesh cyclone was that much of the transportation infrastructure (roads) had been washed away. The ability of military forces—primarily military helicopters, but also landing craft and all terrain vehicles—to reach remote sites is unique.

Storms

Storms include cyclones, hurricanes, and other major severe types of weather. (One of the most significant effects of some storms, flooding, is covered in the next subsection.)

While storms affect a large portion of the earth's surface, only a small portion is vulnerable to a major disaster. The vulnerable areas can be divided according to the ability of relief forces to get to the scene of the disaster, and their exposure to the sea and wind [5]:

- Remote coasts. Mozambique, India, and other Asian and African countries are in this category. Urbanization is concentrated in a few cities, with large stretches of rural coast. These rural areas are vulnerable because they have no road infrastructure or communications system, and because they depend on subsistence farming or fishing.

- Densely populated rural coasts. India and Bangladesh are examples. Large numbers of relatively poor people live and farm in areas that are particularly vulnerable to cyclones.

- Small islands. Throughout the Pacific, particularly in the Philippines and Solomon Island chain, relatively small groups of people are vulnerable to the effects of storms sweeping over their islands. These storms often destroy crops, damage water supplies, and cut off the islands' communications with the outside world.

- Industrialized coasts. Throughout the third (and first) worlds, the coasts are a draw for large populations. These populations set up cities and other urban areas along vulnerable coastlines. Manila, in the Philippines, is an example of a coastal city that is growing in population and is in an area vulnerable to cyclones.

General effects

The effects and consequences of storms are listed in table 11. The table contains three separate, unequal effects that determine the damage from the storm. In most cases for coastal storms such as typhoons and hurricanes, it is the storm surge that causes the greatest loss of life and overall damage. For example, the Bangladesh typhoon of 1991 had an initial storm surge of between 15 and 20 feet. This surge swept over populated islands that were only 1–2 feet above sea level and continued on well inland [63]. Rains, wind, and flooding damaged crops, infrastructure, and housing.

Table 11. Effects and consequences of storms [64]

Effect	Consequences
High winds	Damage to structures Crop/orchard damage
Intense rains	Flooding, which in turn causes: Structure damage Landslides Crop damage
Storm surge	Flooding Salt water intrusion Destruction of crops Destruction of buildings

Table 12 shows some of the generalized requirements for outside relief generated by these storm effects. Short-term needs tend to be met by those already on the scene when the cyclone strikes. Long-term needs can be met by either those on-scene or others arriving to provide relief.

Table 12. General relief requirements for cyclones and windstorms [7]

Short term

Evacuation	Search and rescue
Trauma medical care	Assessment
Food, water, and water purification	Temporary housing

Long term

Road repair	Communications repair
Supply movement to remote areas	Water purification
Electrical generation	

Medical

Medical requirements for relief efforts after a storm depend on whether there was a severe storm surge. Table 13 shows some of the relevant literature's medical assessments following cyclones. Likewise, while there is no immediate danger of disease from cyclones, waterborne diseases can eventually arise because of contamination or destruction of drinking water supplies [7].

Table 13. Medical injuries from cyclones and windstorms [7, 64]

Storm surge	Deaths/injuries	Needs	Period
None	Injuries > deaths	Moderate	72 hours
Severe	Deaths > injuries	Moderate	72 hours

In examining the cyclones and hurricanes that struck from 1995 through 1998, medical supplies were mentioned often but in relatively small numbers. Some examples are shown in table 14. As can be seen in the table, the numbers of doctors and hospitals deployed are

relatively small in most cases. In addition, much of the medical treatment is provided by indigenous forces or organizations. Given that trauma care usually takes place in the first few days of a disaster, it makes sense that much of the care would be indigenous.

Table 14. Appeals or internally provided medical support for some recent cyclones

Cyclone	Support
China, Aug 1997	121 Chinese doctors dispatched
Belarus, June 1997	Appeal for medical support as part of general appeal
Cook Islands, Nov 1997	Three nurses flown from New Zealand
Vietnam, Nov 1997	3,884 "medical kits" provided
Bangladesh, May 1997	63 government medical teams, 3 IFRC medical teams, 2 field hospitals deployed
Philippines, Aug 1997	Philippine Army medical teams deploy
Madagascar, Jan 1997	Medicines flown in

In technologically advanced countries, medical facilities and response capabilities will be better and more widespread, but they will also depend on a functioning infrastructure to be able to operate. Thus, hospitals and emergency response units may be available, but first require that power and mobility (roads) be restored.

Infrastructure

Winds, storm surges, and flooding all damage infrastructure during cyclonic storms. Damage to infrastructure can, in turn, hamper the ability of relief workers to respond to the disaster, as well as affect the overall economy of the country. Table 15 lists some of the immediate effects on infrastructure.

Table 15. Effects of a cyclone on infrastructure [64]

Housing damaged/destroyed	Businesses destroyed, damaged
Public buildings (schools, etc.) destroyed	Disruption/destruction of power (electric, fuel, etc.)
Destruction of communications facilities	Damage to bridges, roads, airports, railroads

Looking at recent cyclones (1995–98), we see that all of the infrastructure components listed in table 15 become important if there is significant wind or water damage. For example, Typhoon Paka destroyed a substantial portion of Guam's electrical power grid. Generators and electrical power repair crews became an important early-response item. Likewise, damage to water supplies is almost invariably listed as one of the consequences of a major typhoon. In addition to contamination or destruction of existing resources, salt water intrusion into normal water supplies can become a problem.

In addition to power and water, the destruction of housing can produce requirements for plastic sheeting and corrugated iron roofing material. Table 16 shows some examples of infrastructure damage and the associated requirements for sheeting or roofing materials.

Table 16. Infrastructure requirements from recent cyclones[a]

Cyclone	Houses destroyed[b]	Requirements[c]
India, June 98	2,000	20 camps housing 10,000 people
Bangladesh, May 98	3,000	No appeal
Tonga, March 97	320	320 tents, 328 tarps
Cook Is., Nov 97	Unknown	250 tarps
Vietnam, May 97	30,000	306,073 roofing sheets 7,521 house frames
Bangladesh, May 97	100,000	200 rolls plastic sheeting
Guam, Dec 97	1,716	600 tents

a. Cyclones where infrastructure damage was specified in reporting.
b. Approximate number of dwellings.
c. Material listed as having been actually supplied.

In this paper we assume that, in general, technologically advanced countries will resemble the United States in disaster management requirements, if not capabilities.[19] Thus we can use the United States

19. The 12 Emergency Support Functions (ESFs) are defined in the U.S. Federal Response Plan (FRP) [65]. In the next section, we will discuss the FRP in greater detail.

as a stand-in to examine disaster response requirements for advanced countries.

Table 17 shows the ESFs that have been active during and after various recent hurricanes that have struck the United States. Table 18 shows the frequence of appearance of various ESFs in table 17. While the data set is extremely limited (only four entries), we can see that ESFs related to infrastructure (transportation, public works, power) and mass care (taking care of the displaced) occur most frequently. This is the result of wind and water damage to roads, power lines, water systems, and housing.

Table 17. Emergency Support Functions during some recent U.S. hurricanes[a]

Event	ESFs
Bonnie, Aug 1998 North Carolina	ESF-3 Public works (debris removal, pumps, generators) ESF-5 Information and planning ESF-6 Mass care (shelters, feeding sites) ESF-11 Food (surveys, food deliveries) ESF-12 Energy (power restoration)
Luis, Sep 1995 Virgin Islands (mild storm)	ESF-1 Transportation (airport closed) ESF-6 Mass care (shelters) ESF-10 Hazardous materials (assessment)
Danny, July 1997 Alabama, Florida, Mississippi	ESF-1 Transportation ESF-3 Public works ESF-12 Energy
Marilyn, Sep 1995 Virgin Islands	ESF-1 Transportation (ports, airfield) ESF-2 Communications (telephone, cellular) ESF-3 Public works (debris removal, water, generators) ESF-5 Information and planning ESF-6 Mass care (food, shelter) ESF-8 Medical and health (support to hospitals, mosquito control, crisis counselling) ESF-10 Hazardous materials (e.g. PCB containing transformers, hazardous material debris, water supply contamination, beach contamination) ESF-11 Food (100,000 pounds per day) ESF-12 Power (restore power, help restore water)

a. ESFs are reported here only if they (a) were in direct support of relief efforts as opposed to supporting the federal or state disaster recovery operations, and (b) involved actual recovery efforts vice standing by or being on alert. The first criterion almost always eliminates ESF-7, Resource Support.

Table 18. Frequency of ESF appearance in table 17 (number out of a possible four total).

ESF	Number
1 - Transportation	3
2 - Communications	1
3 - Public works	3
5 - Info/planning	2
6 - Mass care	3
8 - Medical	1
10 - Hazardous mat.	2
11 - Food	2
12 - Power	3

One important note from Hurricane Marilyn in the Virgin Islands: Because most of their telecommunications lines were aerial vs. buried, the storm wiped out much of the subscriber land-line service. The undersea cable was also cut (and restored with a microwave link). The initial priority was in restoring cellular service, because of the destruction of land-line capability. Central office switching facilities were not damaged.

Economic/Social

Tropical storms generally have two substantial effects on local economy:

- Loss of agricultural production in rural areas

- Loss of tourist income in tropical vacation areas.

Restoration of the basic economic infrastructure can become an important part of the overall recovery process. In particular, in places that are heavily dependent on tourist trade, such as Hawaii, an important part of the overall relief plan may be to open up transportation links for tourists, and reassure them that the islands are safe and habitable again as soon as possible.

In addition to the effect of tourist income on the local economy, tropical storms can have several other consequences:

- As shown in table 17, one of the functions of ESF-8 is crisis counselling. This applies to any traumatic crisis; however, in the case of more technologically advanced countries, provision for mental health counselling may also become an important part of the overall response effort.

- Tropical storms can have a significant effect on the environment. Some specific examples from domestic events include:

  — Oil spills

  — Leakage of toxic materials

  — Fecal coliform bacteria in the water supply and on the beaches from destroyed sewage treatment plants

  — Hazardous debris (e.g., PCB containing transformers).

Summary

Cyclonic storms generate both internal and external relief requirements. Externally, the greatest need appears to be related to the restoration of infrastructure, in particular:

- Communication

- Transportation

- Utilities (especially water and power).

Long term, the response transitions to the rebuilding and repair of houses and other damaged or destroyed buildings, and restoration of the economy. Since many cyclonic storms occur in tropical areas, where much of the economy is tourist based, restoration of the tourist economy may become significant early in the process of recovery.

Volcanic eruptions

As is the case for earthquakes, volcano damage can be severe but the most severe damage is generally limited to a small geographical

area[20] and does not occur that frequently. This tends to keep casualties down. The largest volcanic eruption of this century, Mount Pelee in Martinique in 1902, killed 29,000. The next largest, Nevado del Ruiz killed 23,000 in Colombia in 1985. On average the remaining eruptions killed approximately 1,500 per eruption [5].

General effects

The effects and consequences of a volcano are shown in table 19.

Table 19. Effects and consequences of a volcano [64]

Effect	Consequences
Blast	Damage and destruction of buildings, crops, land, and other infrastructure subject to blast
Laval flow	Fires, permanent destruction of everything in its direct path
Ashfall	Infrastructure and building damage, damage to airfields and aircraft, road closure, earth flows

Table 20 shows some of the generalized requirements for outside relief generated by volcanic activity.

Table 20. General relief requirements for volcanoes [7]

Short term

Search and rescue	Trauma medical care
Assessment	Evacuation
Shelter (housing, food, water)	

Long term

Resettlement, relocation

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20. Indirect environmental effects of large eruptions may be felt worldwide for several years afterward.

Medical

The medical effects of volcanic eruptions are caused by direct trauma, burns, or inhalation of volcanic gasses. Table 20 shows some of the medical requirements for volcanic eruptions. With volcanic eruptions, deaths generally exceed injuries and the surgical needs during the first 72 hours are low (i.e., if victims are caught in the eruption, they most likely die). There are no epidemiological threats from volcanic eruptions.

Table 21. Medical injuries from volcanic eruptions [7, 64]

Deaths/injuries	Needs	Period
Deaths > injuries	Low	72 hours

During 1995–98, eight volcanic eruptions worldwide resulted in a significant international response. Some of the medical requirements for these events are shown in table 22. Burn injuries appear as a common problem during some eruptions. However these occur in (relatively) small numbers in the cases shown in the table, partially as a result of pre-eruption warning and evacuation measures.

Table 22. Appeals or internally provided medical support for some recent volcanic eruptions

Eruption	Support
Indonesia, Jul 1998	Medical teams dispatched to villages
Montserrat, Jun 1997	Three doctors, pathologist, six nurses (17 burn victims)
Nicaragua, Nov 1995	Care for respiratory problems due to ash
Indonesia, Nov 1994	Plastic surgeons for burn victims (22 victims)

Infrastructure

Volcanoes cause damage through three mechanisms: blast, lava flow, and ashfall. Table 23 lists some of the effects that each of these mechanisms has on infrastructure. The important point to remember about a volcanic eruption is that, while the destruction is near

complete in the path of the main blast or lava flow, the overall extent of the damage will not occur over a wide area (relative to other phenomena such as storms or droughts).

In this sense, the most disruptive long-term problem generated by the volcano may be the ashfall. Ash can cover a much wider area than either the blast or lava flow. It can disrupt air and ground transportation, and destroy crops and ecosystems. It can also cause roofs to collapse, particularly when the roots get wet, as was the case during the Mt. Pinatubo eruption in the Philippines. In that case, the eruption was closely followed by a typhoon, which not only weighed down the ash on roofs but caused lahars, or mudflows, as well.

Table 23. Effects of a volcano on infrastructure [64]

Blast/Lava flow	Ashfall
Local businesses destroyed/damaged	Crops destroyed
Damage to land (debris coverage)	Air, ground transport disrupted
Destruction of networked infrastructure (water, power, communications)	Damage to roofs
Housing damaged/destroyed	
Public buildings (schools, etc.) destroyed	

Table 24 contains infrastructure requirements for eight of the most recent eruptions. Most requirements relate to evacuation and resettlement efforts in the days and months prior to the actual eruption.

Economic/Social

The primary economic and social impact of most volcanic eruptions is the evacuation and often permanent displacement of people in the path of the blast or lava flow. In the case of Montserrat, a recently active volcano in the Caribbean, approximately 8,000 people were affected. Over 4,000 left the island; 500 were evacuees, and others were taken in by other Caribbean nations. But approximately 3,500 remained behind on the island, either in shelters or in their original houses (refusing to be evacuated).

Table 24. Infrastructure requirements from recent volcanic eruptions[a]

Eruption	Number displaced[b]	Requirements[c]
Montserrat, Jun 1997	2,000	4 helicopters Transportation Food/Shelter/Fuel for 2,000 Pre-fabricated housing
Nicaragua, Nov 1995	6,000	4,500 emergency rations Blankets Mats Kitchen sets Dust filters, goggles, brooms (for ash cleanup) 250 MT food 4,000 gal diesel oil 100 wheel barrows
Cape Verde, Apr 1995	1,300	Tent camps for 1,000
Indonesia, Nov 1994	6,000	Water supply damaged 3 dams of 350,000 cubic meters of earth to channel lahars[d]

a. Eruptions where infrastructure damage was specified in reporting.
b. Approximate number of people evacuated.
c. Material listed as actually supplied.
d. Lahars are mudslides.

Other significant damage can come from loss of arable land. Lava flows tend to completely destroy what they cover; however, their effects are generally over a limited area. Ashfall is more likely to destroy crops, and, particularly, grazing animals who are left out in even a light ashfall [64].

Natural disasters—slow onset

Floods

General effects

As we discussed in the section on timing, floods are one of the most widespread and common of all the natural disasters. Like earthquakes, their effects are frequently felt at the sub-national level. Often, the areas affected are particular regions of a country or geoforms that are well defined and have repeatedly flooded in the past.

Floods are often caused by tropical cyclones, so the effects of cyclones and flooding in those cases must be added together to get an idea of the overall requirement.

Flash flooding tends to be similar to storm events, producing similar damage and casualty numbers, while the effects of slow-onset flooding tend to resemble those of drought. Slow-onset flooding will often displace hundreds of thousands and kill hundreds, while flash flooding will displace hundreds and kill tens of people. Flash flooding is also associated with earth movements, landslides, and lahars. These, again, are mostly limited in their extent and effects. However, when combined with long periods of rains, multiple rapid-onset events will often produce significant casualty totals.

The general effects and consequences of floods are listed in table 25.

Table 25. Floods' effects and consequences to infrastructure [64]

Effect	Infrastructure consequences
Inundation	Damage to structures
	Evacuation
	Damage to crops
	Damage to roads, and other networked infrastructure
Erosion	Damage to crops and crop production
Mudslides	Localized crop and structure damage

The primary effect of flooding is to damage or destroy both housing and crops from inundation by floodwaters. Flash floods are more likely to result in casualties, but, as with mudflows, their effects will be even more localized than slower-onset flooding. When floods destroy infrastructure, the damage is usually related to roads, bridges, or housing located near rivers or in mudslide-prone areas.

Medical effects

The literature indicates that deaths generally exceed injuries in a flood, and that, overall, the requirements for surgical intervention are low [7, 64]. In other words, most floods do not produce significant trauma or medical casualties. They can produce *some*

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epidemiological threats from spread of waterborne diseases and contamination of water supplies and sewers. Table 26 shows the overall medical consequences for floods, and table 27 contains some of the specific medical requirements from recent flooding. The table shows that waterborne/sanitation-related diseases such as typhoid, cholera, malaria, and diarrhea are potential problems in floods.

Table 26. Medical injuries from floods [7, 64]

Deaths/injuries	Needs	Period
Deaths > injuries	Low	72 hours

Table 27. Medical effects of recent flooding[a]

Event	Effects/requirements
Benin, Aug 1998	Medication for malaria Vaccines for typhoid, meningitis 3 cholera deaths
India, Sep 1998	Mosquito nets, water purification tablets
Pakistan, Mar 1998	Cholera vaccine
Peru, Dec 1997	Increase in malaria, cholera, diarrhea
Ethiopia, Oct 1997	Dysentery, malaria, Rift Valley Fever, anthrax (in cattle)
Kenya, Nov 1997	Rift Valley Fever, other hemorrhagic diseases, cholera, malaria

a. Rift Valley Fever is a hemorrhagic disease common to sub-Saharan Africa. The virus is transmitted by mosquitoes, biting insects, and contact with infected body fluids [66].

Infrastructure

Infrastructure fares much less well in a flood than people do. Table 28 lists some of the effects from flooding.

Table 28. Effects of a flood on infrastructure

Housing damaged/destroyed	Industrial/Civil buildings damaged/destroyed	Crop losses
Rail lines damaged/destroyed	Roads/bridges destroyed	

A look at recent flooding events suggests that damage to roads, bridges, and crops is the most significant impact of large-scale, slow-onset flooding. Flash flooding and mudslides often result in more casualties and greater damage to infrastructure, but they affect far fewer people. Table 29 shows some of the casualty figures for recent flooding, along with some of the relief requirements.

Table 29. Infrastructure requirements from recent floods[a]

Flood	Killed[b]	Population affected[c]	Requirements[d]
Peru, December 1997	340	580	Water, transportation, housing, food, medical
Pakistan, March 1998	300	40	Blankets, tents, anti-cholera vaccine, food, rescue, housing materials, water purification/irrigation materials
India, Jun 1998	278	1,211	Shelters for displaced
China, May 1997	148	35,000	Water, medical, food, clothing, crops
Iran, April 1998	81	60	Tents, blankets, food, roads, bridges
Myanmar, Aug 1997	68	103	Roads, bridges, crops/cattle, schools, clinics, clothing, blankets, food
Philippines, Sep 1998	27	707	Search, rescue, and evacuation
Chile, June 1997	22	65.8	Houses damaged, destroyed, bridges, roads,
Argentina, April 1998	17	290	Roads blocked
Benin, Aug 1998	5	22.5	Blankets, tents, malaria medication, cholera vaccine
Tanzania, May 1998		4.6	Food, tents, bridge repair, water (out in capital), housing supplies

a. Floods where infrastructure damage was specified in reporting.
b. Approximate number of dwellings.
c. Greatest number affected, in thousands.
d. Material listed as actually supplied.

The table suggests (these tables do not represent a statistically valid sample) that flooding tends to affect many people but kill and injure relatively few. Disease appears quite frequently in the situation reports, as does damage to roads and bridges. Damage to transportation networks appears to be one of the primary complicating factors for relief efforts.

Relief requirements tend to center around restoration of housing and provision of supplies to people cut off from normal sources of food and energy.

In addition, in the case of flooding in Peru, archeological and sensitive environmental sites were threatened. Additionally the Peruvian Navy became involved in moving cargo up and down the coast when bridges were washed out by flooding. This both prevented economic losses and allowed supplies to flow to cut-off cities.

Economic/Social

In the case of flooding, the most significant loss in developing countries appears to be loss of agricultural production. Lowlands tend to have rich soil, and hence be favorable to farming. But the rich soil is often the result of periodic flooding, making these low-lying areas prone to flooding disasters. In some cases, however, an increase in rainfall can be used as an advantage by farmers, allowing them to plant additional crops. This happened in Kenya, when some farmers were able to take advantage of a longer rainy season to plant additional crops.

The other significant disruption is to the transportation network. With major cities completely isolated due to loss of roads and bridges, economic activity can be significantly decreased. In the case of Peru, mentioned above, the use of Peruvian Navy ships helped to mitigate some of the impact of this loss of transport.

Man-made disasters

We define man-made disasters to include all disasters with a human origin, other than conflict; however, for this paper, we are limiting our examination of timelines and causes to hazardous materials releases.

Hazardous chemical releases are predominately a hazardous materials decontamination and medical treatment problem. Table 30 summarized the primary steps in managing hazardous materials incidents. While longer-term effects can include economic and social

disruptions, the immediate effects are limited to the scene and treatment of casualties.

Table 30. Hazardous incident management
process [67]

Hazard identification
Personnel protection
Site management
On-scene victim treatment
Transport to hospitals
Decontamination and care in hospitals
Site decontamination
Long-term epidemiology and health care

Casualty and site decontamination may appear to be similar to chemical-biological-radiological (CBR) warfare site decontamination, but often the contaminates are quite different. Personnel Protective Equipment (PPE) and decontamination procedures designed for chemical warfare agents may not always apply to every hazardous material encountered in site decontamination.

For example, the EPA has four levels of protection: from level A, which is the most self-contained, to level D, which has essentially no protection. Most military-issue PPE would fit in the level C category, a full mask and suit with a canister-equipped respirator. Levels A and B both have supplied air respirators. Level A has a fully encapsulating suit [67].

Decontamination procedures will also be more varied in a hazardous materials incident. Solvents may be necessary to remove some substances, and others may be reactive with water, requiring a dry decontamination procedure. While bleach solution may be effective in decontamination of nerve agent, it may be reactive or wholly ineffective against other substances.

The information requirements for a hazardous materials event may also differ from CBR requirements. While most CBR agents are well

defined, the possibilities are much more varied in a hazardous materials release. Reaction between agents, fire, and other catalysts can produce a changing set of contaminates.

However, given the above caveats, equipment requirements for hazardous materials response look similar to those for CBR incidents. Equipment can be divided into materials for on-scene decontamination and personal protection, and hospital equipment. Table 31 lists some of the materials suggested for personnel protection and decontamination during victim recovery, treatment, and transport. It also lists equipment and procedures for hospitals once the patients are transported from the scene.

Table 31. Requirements for response to hazmat incidents [67–68]

Personnel protection

Chemical Protective Clothing (CPC)	Respiratory protection (SCBA/SAR)[a]	

Decontamination

Containment equipment	Water supply	Supports
Scissors (clothing removal)	Detergent	Buckets
Sponges/brushes	Plastic bags	Disposable clothes/ shoes
Towels	Clear body bags	Duct tape

Ambulance

Personal protection (SCBA)	Plastic covers for floor/ seats/etc.	Nitrile gloves

Hospital

Decontamination team	Patient washdown	Wash water containment

a. SCBA, self-contained breathing apparatus; SAR, supplied-air respirator.

Complex emergencies

Complex emergencies occur in an environment where there are security, diplomatic, and economic issues. Often the lack of a secure and stable society is the cause of economic difficulties, which give rise to the need for humanitarian assistance. In turn, the lack of a secure

environment means that humanitarian assistance cannot reach those most in need. These emergencies can have all of the relief requirements of a natural disaster, only made more difficult by the presence of people and organizations that want to use the disaster to further their own political, economic, or social ends.

There are two general ways in which the international community can respond to complex emergencies:

- By attempting to impose some sort of peace settlement on the parties in the hopes that humanitarian relief can occur

- By attempting to conduct humanitarian operations while a conflict, or the threat of conflict is ongoing.

Often both are tried at the same time.

In this paper we divide complex emergencies into the diplomatic, or peacemaking, elements and the peace-enforcement and humanitarian elements. In addition, unlike in the sections on natural disasters, in this section we focus on particular cases in order to develop specific requirements.

Peacemaking

In many, if not most, of the complex emergencies shown in figures 9 and 10, the root cause of the emergency is fighting, either within or outside of the affected countries. Factional fighting, or fighting between states, often disrupts not only the economy of the victim country, but also the ability of aid workers to enter the country and intervene. This means that some form of diplomatic operations, whether coercive or cooperative, will be present in most complex emergencies.[21]

How can, or should, naval forces contribute to this aspect of these operations? If political solutions are fundamental to the resolution of many of these emergencies, support to peacemaking efforts may be

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21. Hence the change in terminology from Complex *Humanitarian* Emergency to Complex *Political* Emergency to better reflect the underlying problems inherent in many of these type of events.

an important part of the military's, and possibly the Navy's, overall mission. To understand what is required, it is important to understand what goes on during the peacemaking part of complex emergencies.

In the next subsections we look at three operations: a complex emergency (Somalia); an armed intervention by U.S. forces (Haiti)[22] where diplomacy had a significant role; and a case of diplomacy onboard ship. We attempt to define principles and patterns that emerge from the use of diplomacy in these operations. While this must be heavily caveated with the fact that "each operation is unique,"[23] patterns that emerge can provide direction to naval forces attempting to integrate or support peacemaking operations.

Somalia

When President Siad Barre was overthrown in January 1991 the political situation in Somalia degenerated into factional fighting. Food was withheld, as a weapon, and the United Nations ultimately felt compelled to intervene to provide humanitarian relief. Without a legitimate government, tribal factions and local "warlords" dominated. The balkanization of the country, combined with ongoing fighting, made a purely humanitarian relief operation difficult.

Ultimately, the difficulty in delivering relief supplies, and the ongoing threat to UN forces, resulted in Operation Restore Hope and the insertion of a large number of Marines and I Marine Expeditionary Force (I MEF) command elements into Mogadishu [57–61].

Given the political situation in Somalia, it was unlikely that the long-term security for distribution of humanitarian and other aid would be achieved without some sort of national reconciliation. Fighting between multiple factions was one of the primary reasons the U.S. military had to go in and provide security for relief supplies. Without some sort of peace between the factions, this requirement would likely continue.

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22. Haiti can be considered more of an unexecuted *coup-de-main* than a traditional complex emergency. See, for example, [53–54].

23. Gen. Zinni, quoted in [69].

United Nations Security Council Resolution (UNSCR) 814 gave the mandate for reconciliation to the UN Operation in Somalia (UNOSOM): "through broad participation by all sectors of Somali society, and the reestablishment of national and regional institutions and civil administration" [56]. UNOSOM did this through a series of many formal conferences, often with formal agendas, held in the regional capitals outside of Somalia. This contrasted considerably with the traditional Somali decision-making process, which brought together clan elders as facilitators and were held near the places of conflict. NGOs and others also sponsored sessions in problem solving or conflict management [52].

The one interpretation of variety and types of negotiations conducted by UNOSOM is shown in table 32. In the Addis Ababa Conference in March 1993, UNOSOM attempted to bring together all of the factions and arrive at a cease-fire and disarmament agreement. This was one of the first of many unsuccessful, large-scale national conferences on reconciliation. The lack of success in these conferences was attributed to:

- The contrast between formal, out-of-country conferences and the traditional Somali style of conflict resolution (using tribal elders)

- The disruption of much of the traditional tribal structure in southern Somalia, where ongoing fighting had disrupted the normal clan structures [52].

Table 32. Types of negotiations conducted in Somalia 1991–95 [52]

Type	Level	Participants	Sponsor
Peace conferences	National	Factions	UNOSOM
Peace initiatives	National	Factions	African states
Peace conference	National	Factions	Local, sub-national
Workshops	National	Local community	NGO
Peace conference	Sub-national	Local community	NGO, sub-national

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In addition to UNOSOM, Horn of Africa states also attempted to reconcile the various factions. These conferences failed for many of the same reasons as the UNOSOM-sponsored conferences, with the additional factor that some or all of the Somali factions considered the sponsoring states biased.

In contrast to the nationwide peace processes, NGOs and local, sub-national groups sponsored several successful peace conferences. One of these, a series of traditional Somali assemblies held in the northwestern portion of the country, resulted in a regionwide reconciliation and a generally accepted administration in Somaliland (the northwestern territories).

During Restore Hope, UNOSOM was responsible for reconciliation and U.S. forces were primarily tasked with securing lines of communication for distribution of relief supplies and providing security for ongoing humanitarian operations. UNOSOM, not the U.S. envoy Robert Oakley, was responsible for negotiations with faction leaders [57,62].

Despite the prominence of UN peace efforts, Oakley began political efforts even before the Marine landing. On December 7–8 he met with clan leaders Aideed and Ali Mahdi to get their cooperation in encouraging people to stay away from the landing sites. After the U.S. forces were ashore, LGen Johnson, Amb. Oakley, and the UN envoy Kittani met again with Aideed and Ali Mahdi over lunch on December 11 to discourage clashes with U.S. forces. The venue for this meeting—the Conoco compound—was chosen because it was both neutral and secure. In warning the clan leaders about clashing with U.S. forces, Oakley reminded them of the massive firepower the U.S. was able to bring to bear during Desert Storm. The meeting was also an opportunity to bring both leaders together to begin talks over reconciliation [62].

Despite the U.S. presence, Ali Mahdi threatened to cancel because he felt the location was too close to Aideed's headquarters. Each leader also brought with him six or seven aides, to serve as witnesses as well as to support their status. The meeting ended with a "seven point agreement," which was signed by the two leaders and witnessed by U.S. and UN representatives [62].

This meeting had several important characteristics:

- It was held in neutral territory, but it was the U.S. presence that guaranteed that neutrality.

- There was (initially) no media presence, putting less outside pressure on the Somali leaders.

- All of the participants were present, but the format was flexible enough to allow the Somali leaders to talk independently of the foreign diplomats.

- There was the reminder from Oakley of the effectiveness of U.S. force in the event it was needed.

- This was a "tactical" meeting, designed to create a more secure environment by getting the local leaders to talk and cooperate. It was not designed to secure reconciliation for all of Somalia, but to ensure that the UN forces could carry out their mission.

This meeting was only one of many that occurred during the process of UN and U.S. involvement in Somalia. The overall process of negotiations in Somalia suggests that:

- Negotiations occurred at a wide range of levels; they included sub-national, national, and international venues and participants.

- Cultural traditions, such as the importance of clan elders, played an important role in determining whether the negotiations were effective. (This can be an important consideration for U.S. forces involved in negotiations at the operational or tactical levels of war)

- There was a balance between coercion (coalition military force) and enticement (relief supplies, a secure environment).

- The negotiation process was nearly continuous throughout the operation (i.e., something would be done almost every day) and involved many different clan leaders, international and UN mediators, and venues.

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Haiti

On 29 September 1991, General Raoul Cedras seized power from the newly elected Haitian president Jean-Bertrand Aristide. Both the Organization of American States (OAS) and the United Nations condemned the coup and called for Aristide's reinstatement.

In October 1991, the OAS dispatched a delegation to Haiti led by Colombian Foreign Minister Augusto Ramirez Ocampo to attempt to persuade Cedras to allow Aristide to return to power. Negotiations culminated, 5 months after they began, with the signing of the Protocol of Washington between Aristide and both houses of the Haitian legislature in February 1992. The negotiations took as long as they did because of a general lack of support for the trade sanctions against Haiti, the divisions within the U.S. government, and the general confusion within the Haitian government [53–54, 70–72].

The Washington Protocol called for a return to an independent civilian prime minister to be designated by Aristide. However, it was declared unconstitutional by Haiti's highest court a month later. The Cedras government was blamed for the agreement falling through.

Despite the falling apart of the Washington Protocol, the Cedras government continued to negotiate with the OAS. Ultimately, the OAS and the UN appointed a joint special representative. The special representative negotiated a joint UN/OAS monitoring mission, which arrived in Haiti in February 1993 [72].

During this time period, the Clinton administration took office and the U.S. policy toward Haiti began to change. In March 1993, the U.S. government appointed a special envoy to Haiti, who began working with the UN/OAS envoy. These joint efforts culminated in April 1993 with a proposal for restoring the constitutional government. This proposal was also rejected by the Haitian military government [71–72].

With the collapse of these talks, UN sanctions were imposed. Cedras then agreed to meet with UN, OAS, and U.S. negotiators in New York. Aristide and his representatives, the United States, Canada, France, and Venezuela all participated in the talks held on Governor's Island from June 27 through July 3, 1993. Ultimately this agreement was also

abrogated by the military government, but not before USS *Harlan County* was turned away from the dock at Port-au-Prince on 11 October 1993 [53–54].

On 16 September 1994, President Clinton appointed a special delegation to Haiti consisting of former President Jimmy Carter; former Chairman of the Joint Chiefs of Staff, General Colin Powell; and Senate Armed Services Chairman, Senator Sam Nunn. Their goal was to persuade the Cedras regime to leave power peacefully [54].

The delegation met with the Haitian leadership on 17 and 18 September. The delegation spoke with the Haitian military high command, influential businessmen, and members of parliament. After two days of negotiation, and with the 82nd Airborne en-route to Haiti, Cedras finally agreed to leave power on 15 October [73].

These negotiations were different from those with the Somalis. There were fewer factions, although they were not simple state-on-state negotiations. Table 33 shows a summary of all the various participants during different phases of the negotiation. The table reflects the large number of diverse participants, and includes not only multiple power centers from Haiti but also state and international organizations.

Table 33. Participants in Haitian negotiations [54, 74]

Category	Individual/Organization
International organization	UN
	OAS
State	United States
	France
	Canada
	Argentina
	Venezuela
Haitian	Gen. Cedras
	President Aristide
	Chief of Police LCOL Francois
	PRAPH leader Emanuel Constant
	Haitian businessmen (money elite)
	Haitian legislators

The timing of the negotiations in Haiti can be divided into three phases: the Washington Protocol, the Governor's Island agreement, and the final Carter-Cedras negotiations. Table 34 summarizes these periods, their outcome, and the time period during which the negotiations occurred.

Table 34. Haiti negotiating periods[a]

Period	Objective	Result	Disposition	Time interval for negotiations
Washington Protocol	Return of Aristide to power	Appointment of interim prime minister by Aristide until he returned	Declared unconstitutional by Haiti supreme court	5 months
Governor's Island Agreement	Return of Aristide to power	New commander in chief appointed by Aristide, Aristide to return October 30, 1993, suspension of sanctions	Haitian military did not comply	7 days
Carter-Cedras Accord	Immediate departure of Cedras government	Cedras left October 15, 17 days after the accord	Cedras left	2 days

a. For an alternative way of organizing the intervention, see [53].

Malta

A recent incident of diplomacy conducted at sea occurred in December 1989 at the Malta Summit between President George Bush and Mikhail Gorbachev. As the Soviet empire collapsed, Bush and Gorbachev decided to meet in Malta harbor (Marsaxlokk Bay) to discuss arms control, economic relations, and regional conflicts. Both leaders had intended an intimate summit conducted within the confines of their respective cruisers, USS *Belknap* and *Slava* [75–79]. However, the weather did not cooperate. Heavy seas forced the meetings to be held onboard a Soviet cruise ship, *Maxim Gorky*, docked alongside the pier. The Soviets had brought the cruise ship to accommodate additional staff. The heavy weather resulted in cancellation of part of one day's meetings, and eventually all meetings were held onboard *Maxim Gorky* [78–79].

This is a very different set of circumstances from those surrounding regional and operational negotiations as part of a contingency operation. We only include this example here because it is the most recent example of shipboard negotiations, and it illustrates many of the same points (under different conditions) that we discuss for small-scale contingency support.

This event was noteworthy for several reasons:

- At the same time we were engaged in the summit, the U.S. was also intervening in the Philippines during a coup attempt against the government of Corazon Aquino. This required the President to maintain shore communications with the ship, which was accomplished with a ship-to-shore cable [26, 78–79]. The White House Communications Agency always supports presidential communications; however, the ability to manage crisis communications and command and control, as well as run cabled communications with the shore for that purpose, can also apply to military commanders, such as CINCs, who are managing crisis or contingency operations while diplomatic negotiations are ongoing.

- The President was able to use the shipboard environment to better manage the press. The President wanted "Camp David atmosphere" onboard the ship and ordered the press to stay far away from both cruisers (not hard, given the weather) [77].

- Having the summit onboard warships was symbolic for both sides. Bush commented on the symbolism of having a peace summit onboard a warship, while Gorbachev commented, "The naval ships have come on a mission of peace. This symbolism gives expression to the radical changes now sweeping the world as it shifts from confrontation" [78].

- The summit was held over a two-day period, with a substantial White House contingent being required onboard the ship. This included staff (Secretary of State James Baker, White House Chief of Staff John Sununu, National Security Advisor Brent Scowcroft, communicators, and Secret Service agents. About half the staff had to be left behind in Gaeta [79].

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Peacemaking and afloat forces

There are many more examples of circumstances where naval forces were, or could have been, involved in peacemaking operations.[24] However, taken together, the three events described above point to several common threads in these operations:

- The importance of the venue where the talks are held. There are several aspects to this:

  - Perceived neutrality. For tactical-level negotiations such as those in Somalia, physical neutrality can be an important symbol for the primary negotiators.

  - Physical security. Physical security was an important factor for the factions meeting in Somalia. Likewise, during the Carter-Cedras negotiations, there was the possibility that the negotiating team would become involved in a potential conflict.

  - Symbolic effect. Symbolism was important in all three cases examined here, but particularly so in the Malta summit. There, both leaders referred to the symbolism inherent in holding peace talks onboard Cold War era warships. Also, holding the Governor's Island talks in New York harbor, away from the UN and downtown New York, allowed the negotiations to be close to the UN but removed from the political protests going on at UN headquarters [72].

- Communications capability. In Malta, the President was negotiating with the Soviets while simultaneously running a U.S. operation to discourage a coup in the Philippines. In almost every such situation, there will many highly placed diplomats and

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24. Other examples of diplomacy conducted on Navy ships include: USS *America* as a secret planning location for resolving the 1967 Greek-Turkish confrontation on Cyprus [80]; USS *Renville*, a troop carrier, used in December 1947 as the headquarters ship for the UN truce commission that negotiated a settlement between Indonesian nationalists and the Dutch [81]; and the Atlantic Conference, a secret meeting in Newfoundland between Winston Churchill and Franklin Roosevelt on 10-15 August 1941 onboard USS *Augusta* and HMS *Prince of Wales* [82].

political leaders converging on the site of negotiations. They can require:

— Communications, not only with U.S. military and national command authority systems but those of other U.S. agencies and the countries participating in the discussions.

— The ability to control access and communications to the venue. In both Malta and Somalia, access by the press was controlled in order to facilitate negotiations. Likewise, controlling the ability of the negotiating parties to be distracted or to communicate with their home office may be an important element in the overall progress of negotiations.

• Coercion. In both Haiti and Somalia, direct coercion was used as an integral part of the negotiations when U.S. forces were involved.

In a maritime environment where negotiations might be taking place, having the option of moving them to a ship offers several advantages:

• Control of who does and does not have access to the negotiations. It is also possible to use the isolation of the ships to control who communicates during the negotiations.

• Neutrality, if the United States is perceived as a neutral party in the negotiations.[25]

• Security. Having almost absolute control over the venue allows the U.S. to guarantee the physical and information security of the talks.

• Coercion. Seeing the forces arrayed against them when they are onboard a Navy ship provides for a subtle coercive pressure on the negotiators.

• Communications and berthing. Larger ships, such as command or amphibious ships or aircraft carriers, can sustain a large

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25. This is an important point that may be beyond the control of the JTF commander, or even the U.S. government at the time of negotiations. However being accepted as an honest broker in dispute resolution can be a big advantage to the United States in some circumstances.

number of personnel and provide substantial communications capability. Specific communications requirements are discussed elsewhere [1].

- Transportation. The availability of helicopter transport from U.S. Navy ships allows the negotiators to come and go, at our discretion.

There are potential difficulties in conducting shipboard peacemaking operations. These include:

- Loiter time. In some cases, negotiations can take months (Haiti), or are made up of many short negotiations that drag out over months or years (Somalia). Keeping ships, particularly high-value ships, on station for long periods of time is a difficult task when the venue could easily be moved ashore. This suggests that short, high-value negotiations with specified end-dates are preferred for shipboard venues.

- Number of participants. In high-visibility international negotiations, such as the Governor's Island agreement, there may be many organizations and nations that require representation. This can mean large staffs and many dignitaries. Accommodating both the berthing requirements and the communications requirements of such a diverse group may be difficult. This is particularly true if, as we recommend elsewhere, a software and communications capability is maintained that would allow the parties to conduct analysis and deliberations using their own software tools and wide-area networks.

Peace enforcement: operations with a security component

As we mentioned in the previous section, many, if not most, operations that have a significant peacemaking effort also have some elements of a peace enforcement operation. In the case of Haiti, the peacemaking occurred instead of the use of force; in the case of Somalia, both occurred at the same time.

In this section, we will focus on the requirements for peace enforcement, as opposed to humanitarian, operations. There is no way we can, in this paper, even begin to review all of the recent studies that

have been done on various aspects of requirements for complex emergencies. Instead, we will break the specific requirements for a series of cases into two sections: security requirements and humanitarian requirements.

Security

Since one of the definitions of "complex emergency" includes security, security operations must be integral to peace enforcement. We can divide security requirements into several areas, based on who is being protected and who is the threat:

- Force protection.

- Protection of relief workers and aid delivery.

- Enforcement of agreements between factions, or UN mandates. In Haiti and Somalia, these included disarmament operations.

- Protection of minorities, refugees, or other sub-national groups that are targeted for genocide or other mass killings.

- Constabulary operations involving the restoration of order and the rule of law.

Force protection

Self-protection can become an important, if not the most important, security operation. In Haiti early concerns about force protection (after the Ranger raid in Somalia) led to stringent force protection measures for Army forces [53, 70]. Force protection requires additional personnel and material to protect against the expected threat. However, force protection in complex emergencies extends beyond simple physical security measures. According to [25, 57–61, 70] it includes :

- Rules of engagement. Lack of aggressive rules of engagement may lead to dangerous lags in shoot/don't shoot decisions, and may lead to the perception of weakness by opposition forces.

- Psychological and nation-assistance operations designed to convince the indigenous peoples that U.S. forces are a positive presence.

- Not taking sides. If no enemy is made, force protection becomes easier.

- Threat awareness and on-scene intelligence. In Somalia and Haiti, special forces and reconnaissance teams provided on-ground intelligence prior to main force movements.

- Pro-active measures such as disarmament and cantonment of weapons. Weapons control has become almost *de rigueur* for operations with a significant security component.

- Coordination with allied forces. In most operations, allied forces will play some role. The seams between allied and U.S. forces can produce gaps in overall force protection.

Protection of aid workers and relief supplies

Protecting aid workers and relief supplies can take on many different forms. These include:

- Protection of distribution points against looting

- Physical security of relief workers and supplies

- Protecting convoys of relief supplies.

Aid workers are under threat in many different situations. Attacks or abuses of aid workers have ranged from the September 1997 detention of the European Union Commissioner for Refugees in Afghanistan to the ambush and killing of aid workers in Rwanda, to World Food Program aircraft being fired on in northern Afghanistan. In most of the cases where relief workers are threatened, there is no military or constabulary presence to protect them. They respond to threats by not going to the high-threat areas, by evacuating staff, and by waiting until the threat lessens before returning. Occasionally the pull-out of aid workers signals the beginning of some international action to establish a more secure environment.

Somalia is an example of a conflict where the international community needed to establish a "secure environment" before aid could be delivered. In Somalia, coalition forces attempted to initiate and maintain a secure environment by first moving into an area (via an assault) then occupying it through patrols and other security actions. References [57–61] report that the initial insertion of forces in Somalia was done through:

- Amphibious assault. Amphibious assaults were conducted to insert troops into Mogadishu and Kismayo. The Marine Expeditionary Unit/Special Operations Capable (MEU/SOC) forces conducted an amphibious assault in order to secure Mogadishu. Kismayo was secured using a combination of a Belgian parachute battalion and a Marine Battalion Landing Team (BLT) embarked on amphibious assault vehicles from the Marine Forces.

- Air assault. Coalition forces made four air assaults by coalition forces used to secure Baledogle, Baidoa, Belet Uen, and Marka in Somalia. Only one of these assaults was conducted by only U.S. Marine forces. The others required coordination between coalition and joint forces. These areas were secured by air because:

  — The road network was difficult to negotiate or nonexistent.

  — Some of the sectors were isolated from the primary areas of operations in Somalia.

  — Few ground transport assets were available early in the operation.

- Ground assault. In Somalia, Oddur, Bardera, and Gialalassi were secured by units travelling overland. In each of the cases, coalition forces either conducted or participated in the assaults. The forces did not travel directly from their camps to the objective; they assembled the day before at a jumping-off point.

Coalition forces also had to control the sectors once they were secured. This meant [57]:

- Manning checkpoints

- Guarding relief supplies

- Patrolling

- Escorting convoys.

Enforcing agreements and disarmament

One function that military forces often perform is enforcement of agreements or UN mandates on various parties in the conflict. Thus, in enforcing a ceasefire, actions may not be very different from those involved in force protection or protection of aid work.

Often, ceasefires are enforced by attempting to disarm the local forces or civilians. Disarmament operations have been conducted in almost every major contingency that U.S. forces have participated in. In Haiti a buy-back and weapons turn-in program was established early in the operation. In Somalia there were attempts to canton heavy weapons and disarm the "technicals," while restricting where and when individuals could possess or display small arms [61].[26]

Disarmament operations are difficult to set up and evaluate. While heavy weapons can be placed in secure areas, counted, and monitored, individual small arms can be extremely difficult to eradicate. Buy-back programs and attempts to constrain the display and public possession of small arms have been tried in various operations.

Furthermore, the problem of disarmament is rife with unintended consequences. For example, in Somalia, weapons confiscation policy became almost immediately entangled with the need by non-government organizations in the country to operate with vehicles and drivers that kept weapons to deter bandits. To pick up supplies, these trucks had to enter UNITAF areas, where they risked confiscation of their weapons. Even while outside UNITAF areas, JTF soldiers had a

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26. Comments by Gen. Zinni.

hard time distinguishing drivers from bandits and confiscated drivers' weapons as well as bandits'. The confusion and some of the attempts at solving it are detailed in [83].

Disarmament becomes even more difficult when no substantial force is present to see that it is done, though there have been some successes, such as Mozambique. The following are examples of disarmament operations based on agreement where difficulties have occurred:

- Angola, where nearly half of the rebel forces (National Union for the Total Independence of Angola, or UNITA) had refused to disarm by September 1998, in spite of a 1994 peace accord (Lusaka Protocol).

- Central African Republic, where in January 1997 rebel and government forces signed the Bangui Agreements and allowed an inter-African force (Inter-African Mission to Monitor the Bangui Agreements, MISAB) and the follow-on United Nations Mission in the Central African Republic (MINURCA) in to supervise the implementation of the agreement. Part of the truce agreement called for disarmament of the rebel factions and other illegal holders of weapons.

- Congo, where local forces attempted to disarm private militias in June 1997, before a presidential election. The resulting civil war killed at least 10,000 and displaced 600,000.

Protection of sub-national or ethnic groups in danger

In several recent events, particular ethnic, tribal, or other sub-national groups of civilians have been targeted as part of a conflict. These include:

- Great Lakes region of Africa. Tutsi-Hutu killings in 1994 as part of a general Rwandan civil war have led to a complex and bloody situation in the Great Lakes region of Africa. Large refugee camps exist. Refugees are targets and are thus afraid to return home. Perpetrators of the killings are also difficult to single out because they are mixed in with refugees [84].

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- Bosnia. Ethnic Muslims have been targeted by ethnic Bosnian Serbs and greater Serbia for "ethnic cleansing." Serbian forces used terror and intimidation in an attempt to move Bosnian Muslims out of areas judged to be Serbian [85].

- Democratic Republic of Congo (DRC)/Zaire. As part of the overall crisis in the Great Lakes region, Zairian troops pursued ethnic Rwandan refugees in the DRC. The persecution of Rwandans arose from a long-standing ethnic conflict between people in the DRC of ethnic Zairian decent and those of Rwandan descent [3].

These situations are characterized by:

- The need to establish legal or other grounds for prosecution under national or international law of those guilty of murder.

- Large numbers of refugees who may find resettlement difficult, particularly when those who attacked them are either co-located in the same camps or have settled in the place where the refugees left.

- Difficulty distinguishing the victims from the perpetrators, particularly when both sides have engaged in ethnic violence.

- An intrinsic barrier to peaceful solutions.

Constabulary operations

By "constabulary operations," we essentially mean the combination of police enforcement and the rule of law. This means having a trained and credible police force that is not given over to corruption, combined with a fair and effective judicial system.

In Haiti, establishing a police and judicial system was an important part of getting the country out of the repression-violence cycle. While U.S. forces found themselves engaged in constabulary operations early in the intervention, particularly in the countryside, the United States and UN quickly intervened with various organizations and programs designed to train and assist a Haitian national police force [53, 70]. Establishing a credible police force in Somalia was also seen as an important means of bringing the country back to a stable and secure environment.

The need for constabulary operations means that either military forces are going to engage in some form of policing activity, or other organizations[27] are going to assume the policing or police assistance role. The range of actions that may be required from military police forces includes crowd or traffic control, security for refugees, and criminal arrest and trial for civilian crimes (when no effective judiciary exists). When U.S. forces intervene, the local population may expect them to ensure the basic security provided by effective and fair police and courts. If this expectation is not met, other mission goals, such as a secure environment, or even own-force protection, may eventually be put in jeopardy [53–54, 70].

Humanitarian

Most complex emergencies will have both a humanitarian and a security component. Even if the crisis is precipitated solely by conflict, there will be the potential for economic and social disruption, as well as refugees. Feeding, housing, and caring for displaced persons can consume much of the overall effort in a complex emergency.

Two general questions arise with respect to the humanitarian component of a complex emergency: What is the overall requirement? And what is the portion of the requirement typically handled by military forces?

Overall

One way to begin to understand the particular requirements for the humanitarian component of a complex emergency is to pick a few individual cases and examine in detail some of the requirements. In this section, we focus on the *overall* requirements for one complex emergency: the civil war in Afghanistan. In the next section, we will focus on what the *military* was required to deliver in two other emergencies: Somalia and Bangladesh.

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27. In Haiti these were the Justice Department's International Criminal Investigative Training and Assistance Program (ICITAP) and the International Police Monitors (IPM).

The war in Afghanistan is an interesting disaster in the sense that the U.S. military has never been directly involved in peace enforcement operations in the country.[28] It is also unique in that the country is located in the Pacific region, as opposed to Africa.

Within the Pacific theater, the civil war in Afghanistan stands out as the principal complex emergency. Fighting in Afghanistan has gone on since the 1973 Soviet-backed coup. The civil war in Afghanistan has gone on since 1989 when the Soviet Union withdrew its forces from the country. Afghanistan has been the subject of much attention from the international relief and development community. Table 35 shows various reports on the size of the humanitarian emergency in Afghanistan and the needs resulting from it.

Table 35. Relief requirements in Afghanistan

Source	Killed (millions)	Displaced (millions) 1996-1997	Food aid (KT/year)
ReliefWeb [20, 86]	1.25 total	2 internally 1 into Pakistan	119[a]
U.S. UN mission [9]		3.5 total	42.3[b]
UN DHA [87]		0.5-1.2 internally 1.4 into Iran 1.2 into Pakistan	
ICRC [14]		0.5 internal 2.55 external	

a. Gross 1999 needs as estimated by World Food Program.
b. For 1996.

From 1996 to 1998, Afghanistan experienced three major earthquakes and two severe floods. In addition, there was an ongoing civil war and transition to a fundamentalist Muslim government (Taliban). Thus, the relief efforts and refugee numbers reflect the results of a series of interconnected calamities.

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28. Air Force aircraft delivered supplies in both 1991 and 1992.

We can also look at specific requirements listed in relief appeals. Table 36 shows various medical requirements listed for 1996 for Afghanistan [88]. In addition to what is shown in the table, large efforts were also made to prevent health hazards from occurring. These include eradicating stray dogs, purifying and supplying water, establishing tuberculosis treatment centers, and treating trauma patients.

Table 36. Medical needs in Afghanistan, 1996

Tuberculosis vaccine	Anti-rabies vaccine	Anti-malaria tablets
Oral polio vaccine	Cholera vaccine	Measles vaccinations
Epidemiological surveillance	Hospital supply and reconstruction	

In addition to the relief medical requirements shown in table 36, there were also requirements for trauma care as a direct result of the fighting. Hospitals that typically support the local population devoted significant amounts of their resources to caring for war-wounded. This meant an increase in the number of surgical teams deployed.

Table 37 shows some of the other emergency relief required that does not fit into an easy category. As can be seen in the table, a wide range of projects go on during a complex emergency. Some emphasize medical, such as narcotics eradication or water purification, while others are oriented toward economic development such as seed and agricultural chemical programs and school building and support.

Military- Somalia

U.S. military operations in Somalia occurred in several different phases. Operation Provide Relief was the initial U.S. response to the starvation in August of 1992. It followed on to a 25-person Humanitarian Assistance Survey Team (HAST) that arrived a few days before the JTF stood up. The mission of Provide Relief was to deliver food aid to southern Somalia. Table 38 shows the various assets and deliveries made by Provide Relief.

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Table 37. Uncategorized needs in Afghanistan, 1996–97

Fuel - cooking and heating	Demining (9.7 thousand mines to be cleared)	Seeds/fertilizer/tools
Trash and refuse removal	Livestock vaccination	Narcotics eradication –Poppy crop reduction –Drug control –Law enforcement
Chicken hatcheries	Drinking water programs (labs, pumps, wells, etc.)	Solar cooking/heating/cooling systems
Solid waste/sewer construction	Humanitarian radio network	Fire extinguishers, agricultural chemicals, printing press
School supplies	Bridge building	Silkworm propagation (industrial development)

Table 38. JTF Provide Relief forces

Troops	858
Equipment	14 C-130 aircraft 2 C-160 German aircraft 3 C-130 Canadian aircraft 1 C-130 Belgian aircraft
Sorties	2,475 total (1998 U.S.)
Food delivered	28,000 tons

Because bandits were taking much of the food being brought into the country, the UN authorized a mission to secure the delivery of food in Somalia. The U.S. responded with Operation Restore Hope. The United Nations Task Force in Somalia (UNITAF) was a U.S.-led force of 19 coalition countries. Table 39 shows the forces involved in Restore Hope.

On an average month, Restore Hope coalition forces escorted 70 convoys outside of Mogadishu (there were many more escorts within Mogadishu) and moved 9 KTons of supplies. An advantage of the convoy escorts was that they significantly lowered the non-government organizations' costs associated with flying food in by air [83].

Table 39. Operation Restore Hope forces

Troops	38,301 total[a] (25,426 U.S.)
Convoy escorts per month (average) [83][b]	70 escorts 700 vehicles moved 9 KTons of supplies
Security points in Mogadishu [83]	46 offices 45 residences 24 warehouses 356 feeding centers 102 health clinics 12 other

a. January 1992 levels.
b. Convoys outside of Mogadishu.

The number of security points, or locations that might call for assistance from coalition troops, was large. Within Mogadishu alone there were 585 locations where non-government organizations operated or had facilities. Thus, it was difficult to provide security for any organization that requested it [83].

Military-Bangladesh

On 29 April 1991, super-typhoon Marian hit Bangladesh. With a 20-foot storm surge that totally submerged low-lying islands for hours and 235 km/hr winds, the typhoon effectively devastated the country's people, economy, and transportation infrastructure. Over 139,000 died during the typhoon.

In response to the devastation of Bangladesh, the United States deployed Amphibious Ready Group Three,[29] en-route back to the United States after Desert Storm, to aid in the relief efforts. Operation Sea Angel began on 12 May 1991. Table 40 shows the forces involved in the operation.

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29. Seven amphibious ships and one support ship.

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Table 40. Operation Sea Angel forces [89]

Forces	Quantity/contribution
Troops	500 (ashore)
Phibgru 3 + 3 MEF[a]	24 helicopters 4 LCACs 3 LCU
U.S. Army	5 helicopters
Royal Navy	4 helicopters
USMC	1,167 sorties (rotary)
Army	886 sorties (rotary)
Air force	194 sorties (fixed)
USMC/USN	Supplies delivered - 695 tons air - 1,450 tons surface craft

a. Amphibious Ready Group 3 and 5th Marine Expeditionary Force.

Because much of the transportation infrastructure was damaged or destroyed, the ability of helicopters and landing craft to deliver supplies became one of the primary capabilities brought to the scene by naval forces. In addition, materials were flown in from Guam and the United States. Table 41 shows the materials and equipment sent or delivered by Sea Angel forces.

Table 41. Operation Sea Angel supplies and equipment [89]

Need	Delivered
Water purification	36 ROWPUs[a] (266,000 gallons of water)
Medical (Six 5th MEB MedCAP teams)	Care for 15,000 patients 38 metric tons of supplies

a. Reverse Osmosis Water Purification Units.

One significant element of the operation was the small footprint ashore. No more than 500 troops from the JTF would be ashore overnight. In part this was to minimize the effect on ashore resources, but it was also due to sensitivities to the newly elected Bangladeshi

government, which was being criticized by opposition and the Indian government for allowing American forces ashore.

Another important aspect of the operation was the participation by the medical civic action program (MedCAP) teams. Prior to arrival, the medical personnel inventoried their supplies: five battalion aid station equipment blocks, five blocks of battalion aid station consumables, and five sick-call blocks. These were designed and equipped to treat combat trauma casualties, and would be far less useful for treatment of civilians, particularly women and children. Most of the relief supplies used by the medical teams would have to come from on-scene sources [89].

Because the storm had knocked out much of the Bangladeshi goverment's communications infrastructure, another contribution of the MEB was providing the JTF, Bangladeshi government, and non-government relief agencies with communications. Small detachments of Marines were stationed with high-frequency (HF) radios at government buildings, relief storehouses, and distribution points [89].

Summary

While no two complex emergencies are the same, they all have similar requirements and tasks. Some of these tasks may be self-inflicted, such as weapons confiscation, while others arise out of the nature of any large-scale disaster that affects people in developing countries (e.g., refugees, disease, lack of shelter).

One of the distinguishing attributes of complex emergencies is the use of force. The force that is used can resemble conventional military operations—for example, "assaults" on areas in Somalia in order to "secure" them, or the raid by U.S. Rangers on an Aidid compound in Mogadishu in support of UN resolutions. However, while the use of force may have many of the elements of a conventional military operation, the *purpose* and *intent* of the operations are inherently defensive in nature and at odds with much of strategic and operational military thought. The goal of establishing a secure and peaceful environment is inherently different from the goal of defeating the enemy forces in combat.

This distinction allows for other missions and requirements to come into the overall security mission. These different missions include separating opposing sides in a conflict, protecting refugees or sub-national groups, disarmament, or constabulary operations. These types of operations require a different pace and a sensitivity to the potential for unintended consequences.

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Who responds now?

Every day, disasters occur throughout the world that do not make the news, much less get noticed by the international relief community, the UN, or the U.S. government. As figure 3 illustrated, there are many reasons that the various relief providers don't respond to a given disaster.

But someone does respond to almost every disaster. It may not be the international community, or the United States, and it is very unlikely it will be the U.S. military, but someone, if only the people affected, will respond. It is this network of responders that the U.S. military encounters when it arrives to participate in relief operations.

Many studies and conferences have been devoted to figuring out how exactly the U.S. military does fit in with these organizations. Our objective here is not concerned with fitting in, but in determining what systems, processes, and capabilities these responders bring to the crisis.

The material that follows should emphasize one important point: many organizations who may show up when a disaster occurs, and they each bring a range of capabilities and resources to bear on the problem.

OFDA

In a foreign disaster, the State Department is the lead U.S. government agency. The ambassador begins the process of disaster response by making a disaster declaration for the country. This allows him or her to automatically receive up to $25,000 from the Office of Foreign Disaster Assistance in Washington.

OFDA Washington then decides whether to deploy a Disaster Assistance Response Team (DART) to the area. The DART is *responsible*

for making an assessment of the disaster and identifying require-
ments. The DART is made up of OFDA Washington officers, OFDA
regional officers, and part-time consultants who are experts in the
subject matter. The DART reports back to the director of OFDA's
disaster response division. It also coordinates closely with the embassy
and USAID when in the affected country. The DART is not necessarily
focused solely on rapid-onset disasters. It can participate in any for-
eign disaster; its mission depends on the type of disaster it is
responding to.

With input from the embassy, National Security Council, USAID, and
others, OFDA Washington then decides on an overall response to the
disaster. OFDA can then release supplies from its prepositioned
stocks, or contract with non-government or other supplier organiza-
tions for disaster relief materials or projects. Figure 25 shows the over-
all flow in military and State Department chains during an overseas
crisis assessment.

Figure 25.OFDA response process [90–91]
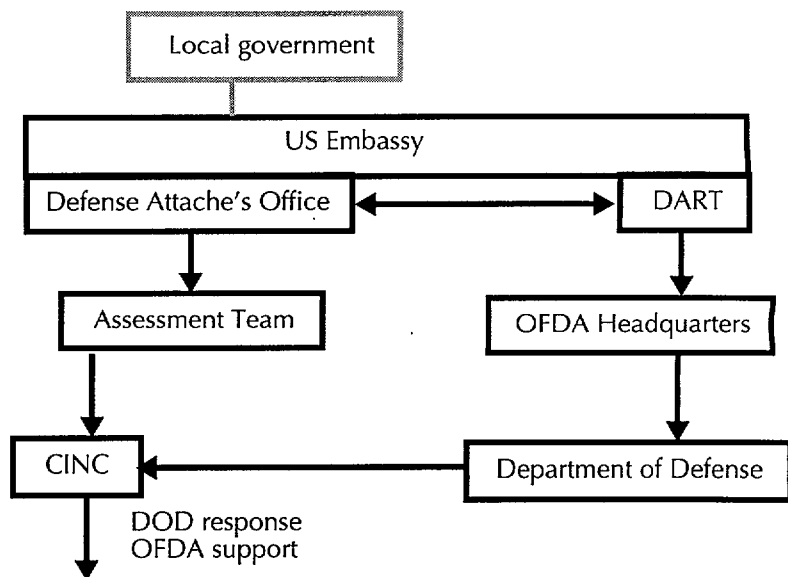
It is important to note that OFDA does not provide direct disaster relief. OFDA makes an assessment, decides on the nature and extent of U.S. government assistance, and provides funds to others to implement programs or operations designed to support disaster relief operations. One advantage OFDA has is that it is not constrained with the normal U.S. government procurement rules governing contracts if those requirements would restrict timely distribution of aid during a disaster [91].

In many cases, two assessment teams will be sent into the country: one by the CINC, and the DART by OFDA. The OFDA DART reports back to OFDA Washington headquarters, but coordinates with the embassy, who is often talking to the affected government. The assessments come back through their respective chains—OFDA, or the CINC. OFDA decides how much money to allocate to the crisis, and whether U.S. military involvement will be required. The Department of Defense, based on OFDA requests and its own assessment of the crisis, may also end up supporting OFDA missions, or its own missions to aid in the crisis.

Figure 26 shows one particular implementation of this process for Hurricane Mitch (a large hurricane that affected Central America in late 1998). In this case, the embassy and the country team worked with the host nations to identify requirements, which were then filtered through OFDA regional headquarters. OFDA liaisons were collocated with the JTF and could provide input on-scene. Requirements (for example, for air transportation or road construction) that OFDA could not fill were sourced to DoD through the Southern Command via the Defense Security Cooperation Agency (formerly DOD/Peacekeeping and Humanitarian Affairs). Otherwise, OFDA could draw on prepositioned stocks of relief materials, or subcontract to local or international relief providers.

OFDA maintains stockpiles of supplies at five locations around the world: Maryland, Panama, Italy, Guam, and Thailand. In Panama, Guam, and Italy, the stockpiles are on U.S. military installations. In the other cases, OFDA manages them through contracts with private organizations. Only OFDA Washington can access the stockpiles; DART requirements are funneled through OFDA Washington. The

stockpiles consist of various types of kits (e.g., search and rescue, chainsaw), tents, blankets, and water containers [90].

Figure 26. SOUTHCOM proposed requirements flow [92]
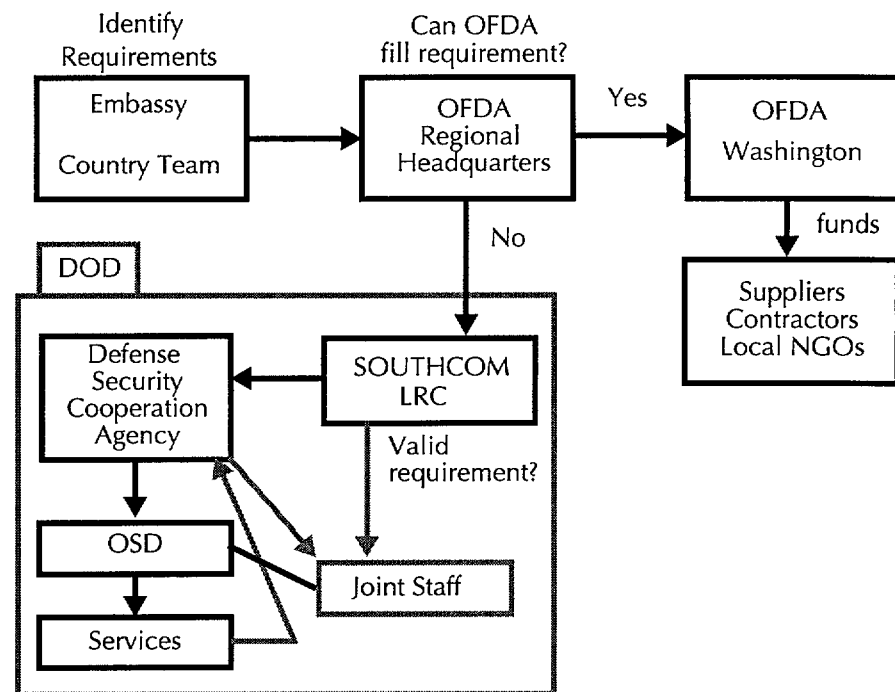
To be effective, the DART has to communicate, primarily with OFDA Washington, but also with the other actors engaged in the disaster response. The primary means of communications between the DART and OFDA Washington is IMARSAT. HF radio, obtained at any number of sites, is the backup. For communications at the scene, the DART uses UHF or VHF radios, typically either commercial or police/fire radios. Often if U.S. search and rescue teams or other U.S. responders are present, they will be using U.S. emergency UHF or VHF radio equipment. Communications with the embassy can be either by radio or by landline. Often, when communications are difficult, the DART relies on embassy cable traffic to communicate with OFDA Washington [90].

In addition to OFDA, USAID has regional bureaus in a number of less-developed countries, which can supply funds or resources as part of recovery efforts [91].

United Nations

The United Nations is not one monolithic body devoted to international governance and assistance. Instead, it is composed of a wide range of semi-independent organizations that perform a bewildering variety of missions. The ones we are concerned with here are the UN Office for the Coordination of Humanitarian Affairs (OCHA, formerly UN Department of Humanitarian Affairs, UNDHA) and those organizations that fall under the broad title of Programs of the United Nations.

UNOCHA

UNOCHA is responsible for coordinating emergency relief. The Emergency Relief Coordinator reports to the Secretary General [93].

UNOCHA is responsible for

- Early warning and emergency information collection and analysis

- Coordinating and facilitating emergency response

- Mission assessments and reports on emergencies

- Facilitating access and coordinating relief efforts of private and non-government organizations

- Serving as a focal point for contributions and mobilization of relief capabilities.

UNOCHA works closely with the Red Cross and other international, private, or volunteer organizations. Since UNOCHA's primary job involves the transmission or use of information, most of its functions were covered in the section, "What types of disasters can happen?: Who predicts and tracks disasters?: UN: UNOCHA."

UNOCHA runs a disaster operations center in Geneva through its Disaster Response Branch. The Field Coordination Support Program of UNOCHA is made up of several other organizations. The most relevant to on-scene emergency management are the UN Disaster Assessment and Coordination (UNDAC) team and the Field Coordination Support Unit (FCSU).

The UNDAC team consists of emergency managers who can be called to travel to a disaster site and perform on-site needs assessments and coordinate international relief. The UNDAC team can support the establishment of on-site coordination centers, such as the On-Site Operations Coordination Center (OSOCC). The FCSU supports the UNDAC team's deployment both before and after its arrival at the disaster scene. The unit has arrangements for deployment of technical and logistics support modules, including office, telecommunications, and transport capabilities [94].

UNOCHA also maintains various registers of stockpiles and capabilities. For example, it maintains a stockpile of items (everything from blankets, towels, and plastic sheeting to NBC kits and transformers) at Pisa, Italy. Other registers include international search-and-rescue teams, military and civil defense capabilities, and various stockpiles of equipment and supplies. This database can be found at [95].

UNOCHA maintains field offices in 16 countries and one region: Afghanistan, Angola, Armenia, Azerbaijan, Bosnia and Herzegovina, Burundi, Democratic People's Republic of Korea, Democratic Republic of the Congo, Georgia, Great Lakes, Republic of the Congo, Russian Federation, Rwanda, Sierra Leone, Somalia, Sudan, Tajikistan.

UNOCHA also maintains a variety of units designed to share information and coordinate responses on a non-real-time basis.

Other organizations

Several of the developmental bodies report to the United Nations through the Economic and Social Council of the General Assembly. These United Nations Organizations (UNOs) include:

- World Food Program

- United Nations High Commissioner for Refugees

- United Nations Childrens Fund

- United Nations Development Program.

World Food Program

The World Food Program is the primary United Nations organization that deals with hunger-related problems. WFP becomes involved in both disaster relief and longer-term developmental projects. WFP has a budget of $1.2 billion and approximately 4,000 personnel. During 1997 WFP shipped approximately 2.5 million metric tons of food.

WFP mostly uses commercial shipping, over 200 vessels per year. Most of the 2.5 MT is delivered by sea transport; only 100 KT are delivered each year by air [96].

WFP operates both large and small aircraft. It currently has long-term leases on Boeing 727, C-130, A-74, and Buffalo aircraft for use in Angola, Sudan, Kenya, and Somalia. Flying hours for large aircraft totaled 12,500 in 1997 and 18,550 for small aircraft. In 1997, two WFP C-130s delivered approximately 7 KT of air-dropped supplies [97].

Small aircraft under lease include Beechcraft King Airs, Cessnas, and DeHavilland Twin-Otters. These aircraft are primarily used for passenger transport and reconnaissance, often using small, underdeveloped airstrips. During 1997 WFP flew more than 45,000 passengers, with the most transported in Angola [97].

WFP also has a logistics planning and prepositioning program: Augmented Logistics Intervention Team for Emergencies (ALITE). This group plans for contingency response and runs logistics standby packages (various packages, including military and civil defense capabilities and strategic stockpiles). In fact, one of the primary goals of ALITE is to ensure proper integration of military or civil defense logistics capabilities into WFP's logistics program [98].

United Nations High Commissioner for Refugees

UNHCR is the UNO with the lead for protection of refugees and the resolution of refugee problems. It is primarily concerned with refugee resettlement, repatriation, and protection of human rights.

NGOs

It is not possible to discuss all of the different non-government organizations involved in disaster response, or the capabilities they bring to the problem. Instead we can ask two questions: Which NGOs are likely to respond? What capabilities do they bring when they do respond?

Table 42 shows the top seven NGOs in dollar amount (approximate budgets of each are $500 million).

Table 42. Top seven NGOs

CARE
World Vision International
Oxfam Federation
Médecins Sans Frontiéres
Eurostep
Coopération Internationale pour le development et la solidarité (CIDSE)
Association of Protestant Development Organizations in Europe (APDOVE)

NGOs in developing countries often tend to focus on development tasks. These can include education, environmental mitigation, food security, health, and economic development. Often, disaster mitigation efforts are also part of overall development efforts. For example, after the super-typhoon hit Bangladesh in 1991, both the Bangladeshi government and the international aid community made considerable efforts to create storm shelters and flood-proof housing. These efforts are still ongoing.

When large disasters strike developing countries, NGOs are often already present in the country doing development work. This can

result in the on-scene NGOs providing some baseline capability for disaster response. This is particularly true for some NGOs, such as OXFAM and IFRC (and local Red Cross/Red Crescent societies).

Cyclones affecting Bangladesh continue to provide an illustration of the influence of NGOs in overall relief efforts. Table 43 shows the statistics for the cyclones of 19 May 1998 and 19 May 1997. Statistics for the 1991 typhoon that resulted in Operation Sea Angel are also shown.

Table 43. Effects of Bangladesh typhoons

Statistic	1997	1998 [99]	1991 (Sea Angel) [89]
Killed	95	26	139,000
Evacuated	1,000,000	615,000	320,000
Storm surge	10-12 ft	12 ft	20 ft

In both cases the overall flow proceeded as follows:

- Bangladeshi disaster management ministry met with various NGOs and others involved in the crisis, and determined what response would be needed (e.g., evacuation).

- International NGOs (such as the IFRC and Action by Churches Together) received notification from on-scene and national NGOs they work with.

- The UN Disaster Management Team met in Bangladesh.

- Local NGO (Red Cross/Crescent) workers assisted with movements to shelters.

- Local NGO branches began collecting storm damage information and transmitting it out via UHF/VHF radio networks.

- On-scene NGO staff began prepositioning supplies, lining up trucks.

- UN and NGO staffs began conducting disaster assessments.

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The experience of disaster management in Bangladesh suggests three points:

- Development efforts can swing to disaster relief before or during a disaster. Existing personnel, communications, and stores can be repositioned to be used in response to the crisis.

- Indigenous NGOs—in this case, the local Red Cross/ Crescent—can play a significant role during the early phases of the disaster.

- Mitigation efforts by the NGO community can result in a significant increase in the capability of the affected country to cope with a disaster. In the case of Bangladesh, the building of storm shelters by NGOs and the implementation of an evacuation network greatly increased the number of people moving to shelters during a major cyclone.

Table 42 lists only the top seven NGOs, but in many disaster situations hundreds of NGOs will respond. Some will have their own procedures and chain of command. Others may be affiliated with an international organization such as the IFRC. This diversity can present its own management requirements on forces. One way forces in recent operations have dealt with NGO diversity is to establish a single center for communications and NGO community liaison. This Civil-Military Operations Center (CMOC) provides an interface between military and civilian relief efforts and allows information and ideas to be exchanged.

Examples of UN, U.S., and NGO efforts

During 1994, eleven UN agencies operated in Sri Lanka. These included UNHCR, UN Population Fund, UNICEF, and WFP. They coordinated their activities through the UN Development Program (now UNOCHA). USAID has an office in the country and supports indigenous disaster management programs. NGOs operating in the country include: CARE, Doctors Without Borders, International Federation of Red Cross and Red Crescent Societies, World Vision, Christian Children's Fund, Hellen Keller International, YMCA, Humanitarian Organization for Poverty Eradication (HOPE), plus hundreds of NGOs operating at the local level [100].

Emergency management

Unless the emergency is occurring in a failed state, or one where the government is extremely fragile and inefficient, some sort of indigenous disaster management capability will be present when the disaster occurs. It is up to the UN, the United States, and the relief community to fit into whatever plans and capabilities the indigenous government has.

We divide the problem of local disaster management into two areas:

- Developed countries

- Developing countries.

In the following sections, we explain what we mean by these categories.

Developed countries

Developed countries have a stable, organized, and capable government whose economy can take the setback caused by a large-scale natural or man-made disaster. Within this broad category, we can include countries as diverse as Japan and Peru. We include countries whose economies are primarily based on information (U.S., Japan) or manufacturing (Korea, Indonesia), and those whose economies are transitional (Latin America, Southwest Asia).

Since Hurricane Andrew hit in the United States in 1992, the U.S. Federal Emergency Management Agency (FEMA) has undergone a significant transition from a Cold War based institution to one capable of flexible disaster response operations in real time. Because of the success of that transition, FEMA has become the model for many developed countries' disaster management capabilities. Therefore we use FEMA's plans and capabilities as a model for developed countries.

The FEMA model will fit better in some cases than in others. In general, the more advanced countries—in particular, Japan, Singapore, Korea, and other developed Asian countries—will have similar plans and institutions. Less advanced countries' plans may look less like

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those of the United States. In the next section, we discuss emergency management plans for several developing countries.

Command and control

The Federal Response Plan (FRP) is the basic planning document FEMA uses for disaster response.[30] The plan has the following basic attributes [101]:

- Federal assistance is always in support of state and local efforts.

- The Federal Coordinating Officer (FCO) is in charge of the emergency response, and reports directly to the director of FEMA.

- The plan is organized into 12 functional areas called Emergency Support Functions (ESFs).

- The ESFs are filled by a combination of government and non-government organizations, with one organization in charge of each ESF.

A request for assistance from the governor of the affected state, and a disaster declaration from the President are both required before FEMA can begin allocating money to the disaster. Once a disaster declaration has been made, FEMA will deploy an Emergency Response Team (ERT) along with an FCO to the state emergency management center. FEMA may also stand up a Regional Operations Center (ROC). After the Disaster Field Office (DFO) stands up, the ROC takes on a less significant role in the operation. Figure 27 illustrates this structure.

In addition to the local and on-scene command and control, FEMA Washington runs the national Emergency Information and Coordination Center (EICC), which houses the watch team (Emergency Support Team) for each of the ESFs as well as the policy committee, the Catastrophic Disaster Response Group (CDRG). The Disaster Response Group is chaired by the FEMA Associate Director, Response and Recovery, and has senior representatives of all the departments included in the FRP.

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30. This does not include response to terrorist or radiological incidents.

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Figure 27. FEMA operations [101]
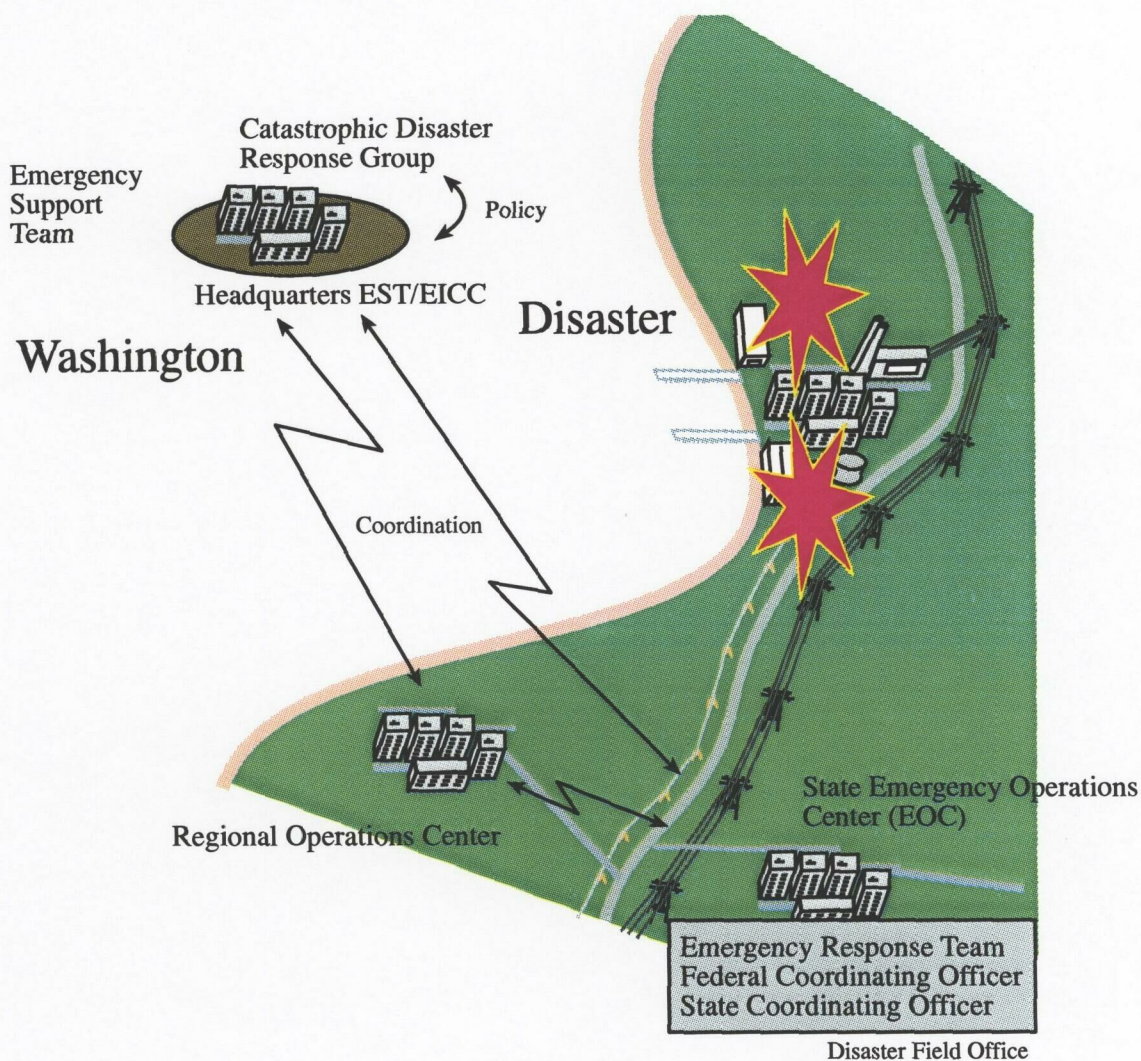
The regional and state operations centers coordinate with the national operations center, and the various agencies in charge of the ESFs. In addition to national, regional, and state centers, FEMA also maintains five Mobile Emergency Response Support (MERS) detachments, and one Mobile Air Transportable Telecommunications System (MATTS). These systems are designed to support the Emergency Response Teams (ERTs) and Field Coordinating Officers (FCOs) when they arrive at the disaster. The MATTS is located in Virginia, and the MERS are in Massachusetts, Georgia, Texas, Colorado,

and Washington state. They are on 4-hour notice to be en-route to the disaster scene. (For a detailed description of MATTS capabilities, see [1].)

MERS provides the ERT with logistical support. Table 44 shows some of the logistics capabilities associated with the MERS. Remember, this is support to the ERT, not to the overall disaster. The bottom line is that the MERS is designed to support up to 100 people for 10 days.

Table 44. MERS logistics support [102]

Generators			
400 KW	175 KW with UPS[a]	Two 40 KW	Two 110 KW
Heating or AC unit			
Truck mounted	Provides H/AC through ducts		
Diesel fuel resupply			
Two 3,500-gal tankers	Three 2,000-gal tankers	Two 1,200-gal tankers	
Potable water			
Two 3,000-gal tankers	Water purification unit	Water bladders	
ETS-S trucks			
Supplies for 100 people, 10 days	Clothing	Hygiene supplies	Food
Sleeping accommodations	Administrative supplies	Forklift	First aid

a. Uninterruptable Power Supply.

Within the overall government structure, at least one U.S. non-government organization, the American Red Cross, has statutory responsibility (under the Stafford Act) to provide mass care to disaster victims. This places a non-government organization within the scope of a government function (the FRP). This is similar to IFRC local organization's work in Bangladesh to evacuate vulnerable populations to cyclone shelters.

Emergency Support Functions

Table 17 lists the 12 ESFs and the corresponding agency in charge of each function. This does not mean that the agency is solely responsible for that ESF. Rather, it is responsible for coordinating all of the supporting agencies and requirements associated with the function. In almost all of the ESFs, other government agencies also appear as supporting agencies to the one listed in the table. For example, while DOD appears as the primary agency on only one ESF, Public Works and Engineering, it is a supporting agency on all other ESFs.

Table 45. Emergency Support Functions (ESFs) [101]

ESF	Primary agency
1 — Transportation	Dept. of Transportation
2 — Communications	National Communications System
3 — Public Works and Engineering	U.S. Army Corps of Engineers
4 — Firefighting	Forest Service
5 — Information and Planning	FEMA
6 — Mass care	American Red Cross
7 — Resource Support	General Services Administration
8 — Health and Medical Services	U.S. Public Health Service
9 — Urban Search and Rescue	FEMA
10 — Hazardous Materials	Environmental Protection Agency
11 — Food	Department of Agriculture
12 — Energy	Department of Energy

One important aspect of the FRP is that all of the functions, except ESF-7, support relief operations. ESF-7, Resource Support, is focused on providing logistics and resource support to federal organizations responding to the disaster. It includes such things as food and transportation, but only for the immediate relief activities. Bulk food transportation, for example, would come under ESF-1, Transportation. ESF-7 coordinates with Transportation, however.

As part of ESF-7, the General Services Administration is responsible for housing, setting up, and provisioning a Disaster Field Office. The DFO is required to be operational between 12 and 24 hours after the plan is implemented.

ESF-6, Mass Care, is also unique in that a non-government agency is the primary agency in charge of coordinating relief operations. Mass care essentially means feeding, housing, and caring for displaced and affected populations. Planning assumptions are that mass care will be required for up to 300,000 victims. Relief is provided without external support for the first 72 hours, and continues for 30 days with external support [101].

In addition to mass care, the Red Cross is also responsible for a Disaster Welfare Information (DWI) system. The system must be able to respond to up to one million inquiries on the status of disaster victims. It also is used to track and reunite separated victims in the disaster area [101].

In technologically advanced societies, utility services and food distribution are more centralized. This makes it easier to collect materials and to respond to victims' needs: for example, you may have to fix only one major water supply source instead of a hundred wells. However, it also means that if the road, rail, fuel, power, and water networks that supply these resources are brought down, the problem may be more difficult to solve than it would be in a developing country where resources are more widely distributed.

In the Federal Response Plan (FRP), Emergency Support Functions covering power, water, and other utilities rely heavily on private sector capabilities to assist in utility restoration. Particularly for power and telephone systems, private industry is the principal supplier of repair and restoration capabilities. Federal efforts are focused on life-saving and relief requirements for utility services.

Developing countries

After Typhoon Linda hit in 1997, the Government of Vietnam requested UNDP assistance to establish a Disaster Management Unit. The FEMA plan [101] later reported:

> The effort has created the Disaster Management Communication System (DMU Net), which provides reliable data and voice communications between disaster-stricken areas in 17 provinces and the government in Hanoi. UNDP assistance is also helping build or reinforce 800 kilometers of sea dikes

in central and Northern Vietnam to protect villages from floods.

Vietnam is not alone. With an increased international focus on disasters, many of the developing countries have indigenous disaster response capabilities. These organizations frequently are able to draw on local disaster response capabilities, similar in concept to the U.S. Federal Response Plan, to conduct emergency relief operations. Even when local capabilities are overwhelmed by the scale of a disaster, they will still be present.

In 1987 USCINCPAC tasked United States Army Pacific (USARPAC) with developing a program to assess the disaster preparedness capabilities of Pacific states. This Disaster Preparedness Planning Survey (DPPS) system is designed to [100]:

- Evaluate the preparedness of host governments to manage likely man-made or natural disasters

- Assess the role of the U.S. military in disaster relief

- Recommend possible domestic or civic action projects which would help with disaster mitigation.

In this section we examine the disaster response systems for three very different countries covered under the DPPS: Sri Lanka, Bangladesh, and the Cook Islands. Sri Lanka and Bangladesh are medium-sized developing countries with very different histories of disaster and internal civil conflict. The Cook Islands make up a small, Pacific island state with limited response resources.

Sri Lanka

Sri Lanka experiences few extreme natural disasters, but it is prone to the Indian subcontinent's seasonal rains, which bring flooding, landslides, coastal erosion, and subsequent dry-season droughts. Sri Lanka does not experience cyclones as frequently as Bangladesh; however, it has been struck by major cyclones in the past. Sri Lanka has also been caught in a man-made disaster: a civil war with the Tamil rebellion in the northern parts of the country.

Between the civil war and government turnovers, there were only limited disaster management capabilities in Sri Lanka when the DPPS was conducted in 1994. The team found [100]:

- Local-level disaster management was adequate for the isolated landslide, flood, or other low-intensity disaster. This response mostly consists of local populations helping each other out.

- The government response plan did not yet exist.

- The Director of Planning for the Ministry of Shipping, Ports, Rehabilitation, and Reconstruction was the de-facto ministry in charge of disaster response. The Ministry of Shipping took the lead in a Cabinet sub-committee charged with developing disaster management legislation. At the time of the DPPS survey, the national disaster plan had not passed Parliament.[31]

- The Sri Lanka Police Department has developed a Major Disaster Contingency Plan that details police procedures and responsibilities in a disaster.

- Other than search and rescue, the Sri Lanka military has been wholly devoted to prosecuting the war against the Tamil rebels.

The National Disaster Management Plan (i.e., the unpassed legislation) called for disaster management in the following broad areas [100]:

- Preparedness, mitigation, prevention

- Recovery, relief, rehabilitation, and reconstruction

- Disaster-prevention awareness

- Establishment of "vigilance groups" to watch for disasters

- Establishment of hamlet, divisional, district, and provincial disaster management committees

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31. Because of the extended war with the Tamil, the national disaster-response plan had sections dealing with conflict-specific relief, including refugees, restoration of services, and other civic action tasks. These are usually not part of most governments' internal disaster-response plans.

- Facilities and equipment

- Meteorological observation, forecast, and warning

- Control measures.

With the addition of a National Disaster Management Council, the plan would establish up to five bureaucratic levels of disaster management on the island. The goal was to better use resources down to the local level, as much of the current response was at the local level anyway.

In addition to the committees, there were also four "Technical Advisory Groups" for floods, landslides, epidemics, and industrial accidents. Their job in the plan was to advise the national-level council and provide technical assistance for warning and alert systems.

In 1994 early warning systems did not exist; instead, people relied on meteorological information transmitted via police and other mobile radio systems. The telecommunications system is hardened against both flooding and cyclone-force winds. The national landline system consists of four territory exchanges combined with 50 main and automatic exchanges which support units throughout the country. Almost all of the country's system has converted to digital technology. The country also has four IMARSAT terminals which can be used or leased by government agencies. Telecommunications in the northern part of the country are severely degraded by rebel activity. Police and military forces rely on hand-held FM and cellular phones.

During an emergency, the local police stations become the forward command posts, with no clear chain of command back to the federal government. At the time of the DPPS, the federal role was in flux from the Ministry of Defense (primarily for man-made emergencies) to the Ministry of Shipping (for natural disasters). There were no stockpiles of emergency supplies.

The most likely scenario for a disaster request would be a major cyclone striking the country. In that event, the Sri Lankan government would be hard pressed to mount an effective response.

Bangladesh

In March 1998, a DPPS survey was made for Bangladesh. Unlike in its neighbor to the south, Sri Lanka, major disasters are common in Bangladesh. In addition to being one of the poorest and least developed countries, it also is struck by a major typhoon almost every other year. Because much of the country is at or below sea level, 10–20-foot storm surges can devastate the coast. In the 1991 super-typhoon, some islands were covered by tens of feet of water for hours.

In addition to cyclones, Bangladesh is also prone to flooding and earthquakes. Other possible disasters include tornadoes, droughts, population displacement, and epidemics.

Unlike Sri Lanka in 1994, Bangladesh in 1998 actually has a ministry responsible for disaster relief (the Ministry of Relief and Rehabilitation), and the Standing Operation Plans of 1994. The plan clearly spells out ministerial responsibilities and supporting activities. The DPPS assessment found that the plan had three primary limitations: it was not adequately exercised; it is unwieldy, both in tone and size; and it may be overly complex [103].

In addition, the team found that:

- Communications were inadequate both within the defense forces and between the defense forces and civilian agencies.

- Transportation, air or ground, is inadequate. In particular, helicopters and hovercraft are in short supply and are needed to service isolated, remote areas or islands.

- Internal and external training and rehearsal opportunities should be used to better understand the plan and its limitations.

- Bangladesh is often reluctant to ask for outside assistance (a frequent occurrence in the international emergency situation reports) because of national and governmental pride. This can severely limit international response; many countries and organizations, such as the U.S. will not provide assistance without a request from the foreign government.

The Ministry of Disaster Management Relief is a cabinet-level office. It is responsible for disaster relief, including non-government and international relief organizations.

Figure 28 shows the Bangladeshi disaster management organization. The National Disaster Management Council—along with its executive agent, the Inter-Ministerial Disaster Management Coordination Committee—coordinates policy-level response and resource allocation across agencies. The Ministry of Disaster Management Relief is assisted by the Disaster Management Bureau and local-level councils and committees.

Figure 28. Bangladesh disaster management organization [103]

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                    ┌─────────────────────────────────────────┐
                    │  National Disaster Management Council    │
                    └─────────────────────────────────────────┘
                                       │
        ┌──────────────────────────────────────────────────────────┐
        │  Inter-Ministerial Disaster Management Coordination        │
        │                     Committee                              │
        └──────────────────────────────────────────────────────────┘
                                       │
                ┌──────────────────────────────────────────┐
                │  Minister of Disaster Management Relief    │
                └──────────────────────────────────────────┘
                       │                        │
                       │                        │   ┌──────────────────────────┐
                       │                        ├───│ Cyclone preparation      │
       ┌─────────────────────────────┐          │   └──────────────────────────┘
       │ Disaster Management Bureau   │          │
       └─────────────────────────────┘          │   ┌──────────────────────────┐
                       │                         ├───│ Emergency Operations Center│
                       │                         │   └──────────────────────────┘
       ┌─────────────────────────────┐          │   ┌──────────────────────────┐
       │ Disaster Management          │          └───│ Foreign Assistance and   │
       │ Committees/Councils          │              │ Disaster Planning        │
       └─────────────────────────────┘              └──────────────────────────┘
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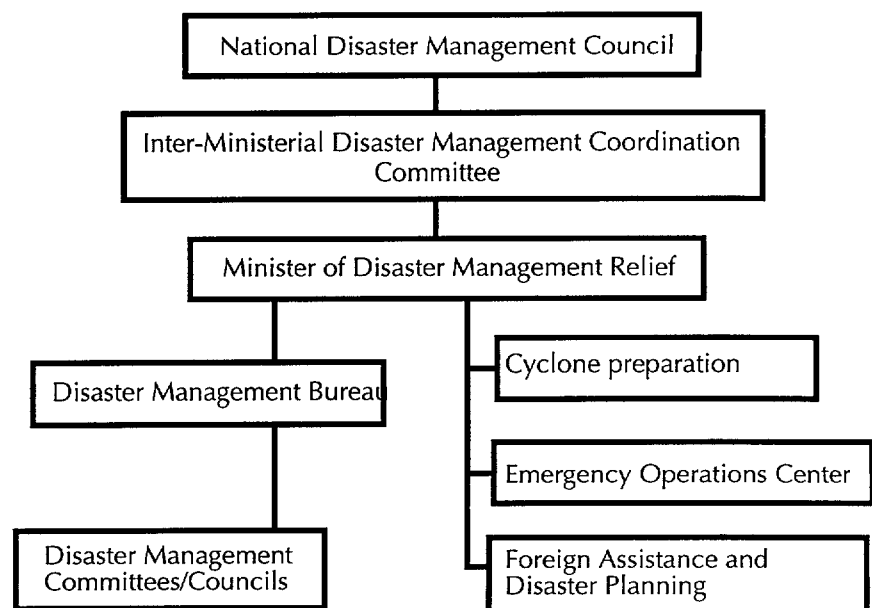
At the local and council level there are four additional levels in the disaster organization: Division, District, Thana, and Union. At each of these levels, civic administrators are responsible for planning and implementing disaster action plans.

In addition to the lack of rehearsal, communications between the various government agencies and the military are limited. The military

cannot talk directly to civilian agencies, and the different military services cannot talk directly to one another [103].

Cook Islands

The Cook Islands represent a very different set of disaster planning problems from those of either Sri Lanka or Bangladesh. They are 15 small, isolated islands in the central Pacific. They are also relatively well off economically, with a mix of tourism and agriculture. Periodically they experience severe cyclones, which can significantly damage local infrastructure and limit the islands' ability to deliver relief supplies. Other disasters, such as earthquakes or tsunamis, have not occurred in recent times.

To deal with the cyclone threat, the islands have developed the Cook Islands Hurricane Safety Plan. When a cyclone warning is received, a central hurricane center stands up. The police commissioner is the head of the Hurricane Safety Commission, and in charge of the hurricane operations center. In addition to the police commissioner, the heads of all the other governmental departments are present at the operations center (making for short communications channels).

Figure 29 shows the command and control system for a cyclone. The Chief Hurricane Safety Officer works directly for the Chief of Staff of the Prime Minister's Office (a cabinet-level position). The Chief of Staff chairs that National Disaster Management Committee, a group made up of public works, radio, health, postal, and internal affairs department heads.

While the concept calls for central control, that is not always possible during a cyclone. Each of the islands, in turn, has a Chief Administrative Officer (CAO) who is in charge during a disaster. During a cyclone, the CAO operates the hurricane center for that island.

Inter-island transportation is one of the most critical vulnerabilities. With distances of over 100 miles between islands, air and water transport are the primary means of travel. When cyclones affect ports and airfields, islands can effectively become cut off.

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Figure 29. Cook Islands disaster management [104]

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                    ┌─────────────────────────┐
                    │   Prime Minister's Office │
                    └─────────────────────────┘
                                 │
        ┌──────────────────┐    ┌─────────────────────────┐
        │ National Disaster │───│ Chief Hurricane Safety Officer │
        │ Management Committee │    │   (Police Commissioner)  │
        └──────────────────┘    └─────────────────────────┘
                                         │
                              ┌─────────────────────────┐
                              │ Chief Administrative Officer │
                              └─────────────────────────┘
                                         │
                              ┌─────────────────────────┐
                              │ Chief Administrative Officer │
                              └─────────────────────────┘
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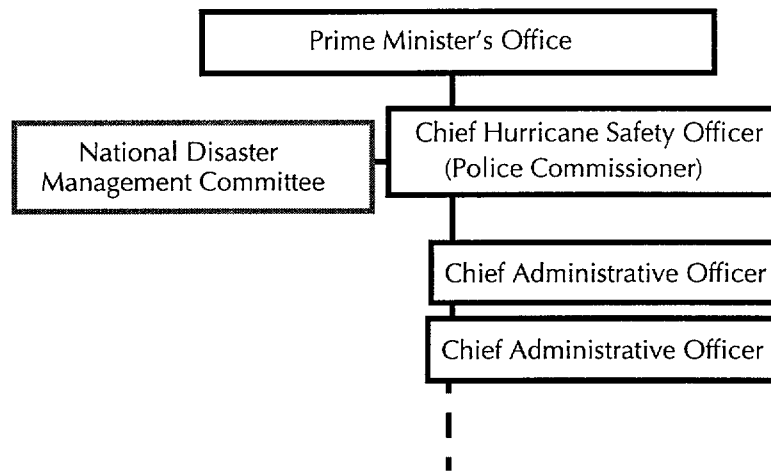
The Cook Islands' biggest international supporter (aid, debt, etc.) is New Zealand. During Cyclone Martin in November 1997, New Zealand dispatched a relief flight with emergency relief goods, and telecommunications equipment and technicians. In addition to temporary shelter and food, the primary requirements centered on restoration of utilities, primarily telecommunications, and ports and airfields [105].

One of the primary industries in the islands is tourism from New Zealand and Australia. When cyclones damage infrastructure (including hotels), tourism drops. A small storm in January 1990 reduced visitors' arrivals by 10 percent from the previous year.

Summary

Dealing with indigenous disaster management operations, in either advanced or developing countries, presents several challenges:

• Complex bureaucratic procedures. In the case of the United States, the problem is the relationship between the State and Federal governments, and how funding is transferred in support of an operation. In the case of other countries, it can be overlapping, or competing, bureaucracies that deal with similar parts of the disaster response problem.

- Layers of disaster management. With local, state, national, international, military, and non-military organizations all showing up at the same time to participate in relief operations, the disaster management process can be complex. Often, similar functions will be performed at different layers in the organization. The coordination problem can become substantial, unless some overarching organizing plan is implemented (such as the FRP).

- Variety of management structures and organizations, and the variability of individual experience and training within those organizations.

- Closer integration of interagency, non-government, and military functions.

- Lack of experience, or the wrong kind of experience. Many countries experience natural disasters of substantial magnitude only occasionally. When disasters become routine, mitigation and preparedness become higher on governments' priority lists.

Where does the Navy fit in?

The previous sections suggest the following:

- Of all the disasters that occur around the world every day, the the international community becomes involved in only a small number. The U.S. military becomes involved in only a fraction of these.

- A wide range of organizations are beginning to develop disaster prediction and tracking systems. These systems often depend on the focus and orientation of the particular organization that is involved in the tracking effort; for example, military intelligence channels tends to focus on conflict.

- Afloat forces depend more than others on early warning and decision making. If naval forces have even a reasonable lead time (as is the case in many disasters), ships can move even before a decision to commit forces has been made.

- Once they arrive, naval forces need to understand where they fit into the overall timeline of the relief effort. Since others will be involved, naval forces do not necessarily need to provide everything. In fact, disasters often have the same set of requirements from one to another. These similarities allow for prediction of specific requirements and pre-planning of response.

In the following sections, we will discuss each of these concepts in turn.

Not all disasters are created equal

Depending on the definition used, disasters are occurring all the time, all over the world. Even the relief community gets involved in very few of these disasters; there simply are not enough resources or attention to go around. A kind of disaster triage must be practiced, with only the worst cases referred to the international community.

Determining when and where a particular disaster will occur that will warrant involvement by U.S. military forces depends on:

- The ability to predict the hazard. For almost every type of hazard there is some corresponding methodology for predicting when it will occur, and what its magnitude will be. This is especially true for natural disasters. In many cases, however, the timeline for the prediction will be difficult to deal with operationally, as is the case for probabilities that an earthquake will occur in a given area, or where a hurricane will hit over the next few days.

- The vulnerability of the affected population. Almost as much as the degree of disaster, how vulnerable a population is to a hazard will determine how severe the consequences are. For complex emergencies—in particular, famine and drought— several organizations have begun to develop models that allow long-term prediction of food requirements based on past economic performance.

- The political environment. Even after an event occurs, the involvement of the international community, the U.S. government, and especially the U.S. military involves a political decision. This is perhaps the least predictable element in the overall process of determining likely scenarios.

This result presents both an opportunity and a challenge for planners involved in deciding where and when afloat forces may be used: models and predictions of disasters can be made and are being developed; the challenge is to judge the political determination correctly.

Disaster intelligence exists

Although many organizations (far too many, in fact, to list in this paper) are working on disaster prediction, only a small fraction of this information appears to be currently making its way into the military decision-making process. Mechanisms, such as the efforts at the Pacific Center for Excellence and the Pacific Disaster Center to serve as "information brokers," are first starts at crossing the barrier between military intelligence and non-U.S. government information.

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However, despite all the efforts at tracking disaster and contingency requirements in the intelligence community, it is the *emphasis* that the various sets of requirements are given that determines whether the information is heard and used operationally. Ultimately, it is an operational attitude toward the information stream that determines what information is provided by the intelligence community.

Because naval forces can be slower to move than air forces, naval commanders may wish to consider how they can better integrate existing information sources into daily planning and briefing, whether or not the joint community decides to do so.

Afloat forces can get there

In almost all of the disasters we looked at here, one thing was clear: naval forces have several days to a week available to respond to a disaster. This allows considerable time for forces to get underway and steam toward the site of a disaster. They have this time because even in instantaneous disasters a process occurs before the international community is galvanized into action:

- The disaster occurs. In the case of some disasters, this can take days (storms) or even years (drought, volcano).

- The local government must assess the damage and make an appeal (often days or weeks when areas are inaccessible).

- The international community must organize an assessment and response (more days).

All this means that most disasters do not occur instantly, and afloat forces can have a chance of arriving at almost any type of disaster in order to assist ongoing relief efforts.

Afloat forces will not be alone

In almost every type of disaster, there will be some local or international response. In many cases, this response will bear the brunt of actual relief operations: rescue, feeding, shelter, and long-term recovery. Military forces will be there to assist the existing capabilities.

Typically, the types of assistance military forces can provide fall into three general categories:

- Security

- Sustainment

- Communications.

The following sections will briefly cover each of these categories.

Security

Security operations are the most likely situation for which military forces will not have significant help from either the host nation (whose forces may actually be causing the security problem) or the international relief community. However, U.S. military forces will most likely be part of a coalition, as they have been in almost every recent intervention.

Security operations in a complex emergency will not necessarily involve the same task set as typical warfighting operations. Patrolling, convoy escort, and constabulary operations often dominate. Precision strike and long-range fires occur much less often. This presents an important challenge for afloat forces: How are these sustained operations done from afloat platforms? We examine this question in [1].

Sustainment

Sea-based forces bring two important capabilities to sustainment operations:

- A secure platform

- A means of transporting and delivering supplies.

As we have noted in the previous sections, many other organizations, governments, and international organizations have significant capability to transport and distribute relief supplies. Networks of prepositioned supplies, aircraft, helicopters, and trucks, and database management software are all being used by the relief community.

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Sometimes, however, these systems break down, either because of the size of the disaster, or because the systems are not designed for the terrain or situation where the disaster has occurred. The 1991 typhoon in Bangladesh is an example of a situation where much of the infrastructure was destroyed, and overland travel was difficult. Likewise, the remote coast of Mozambique and isolated relief camps in northern Kenya are best reached with aircraft. In these situations the discipline, flexibility, and maintainability of military systems can make military aircraft the method of choice for delivery of supplies.

A sea-based supply capability is also unique to the U.S. military. However, two things may limit its overall application: a lack of scenarios where sea-basing of relief supplies is needed, and the ability to re-stock ships in theater with out-of-theater supplies. New concepts such as operational maneuver from the sea (OMFTS) and sea-based logistics may overcome the second limitation. Details of sea-based sustainment are discussed in [1].

Communications

Relief organizations are getting more sophisticated in their capability to gather, analyze, and disseminate information. As we discussed in previous sections, non-government organizations are beginning to standardize on mapping and database software to allow for information exchange. Mobile communications suites are beginning to move out to the field, allowing connectivity between on-scene workers and their headquarters. Prediction tools, for determining where disasters such as droughts will occur, are also beginning to come on line in international (UN) and non-government organizations. Finally, as governments become more sophisticated in their disaster management capabilities, indigenous disaster management networks will be deployed.

When U.S. naval forces show up to participate in relief operations, they will encounter this complex and sophisticated communications and information environment. While all types of military forces must determine how to become part of the information stream from these various organizations, afloat forces must also decide whether to support the information capabilities of these organizations. Because

afloat forces offer the unique combination of communications connectivity and a secure location removed from the disaster area, they have the ability to provide housing and resources for the other organizations responding to the disaster.

References [1 and 2] discuss how naval forces could integrate relief community communications, analysis, and database systems into existing command and control capabilities.

Appendix A: Crisis response tables

This appendix lists crises supported by U.S. government operations. Table 46 lists U.S. government support to emergencies in fiscal year 1997. (Note that it lists a greater number of complex emergencies than any other type of crises. Also note that two regions seem to be particularly prone to complex emergencies: the Horn of Africa and the Great Lakes Region.) Table 47 lists U.S. Navy or Marine Corps operations in support of crises from 1990 through 1997.

Table 46. OFDA support to disasters (Asia, Africa, western South America,[a] Central America, and Near East), FY1997 [19]

Disaster	Number	Total USG assistance[b] (thousands of dollars)	Countries
Storm	5	24.5	Madagascar
		159	Bangladesh
		25	India
		128	Laos
		25	Vietnam
Flood	7	25	Malawi
		24.6	Mozambique
		25	Burma
		47	Cambodia
		50	Mongolia
		25	Honduras
		191	Honduras
Earthquake	3	25	Iran
		100	Iran
		277	Peru
Other	2	39.5	Chad (epidemic)
		25	The Gambia (epidemic)
Drought	3	3,594	Chad
		4,378	Kenya
		1,788	Mauritania

Table 46. OFDA support to disasters (Asia, Africa, western South America,[a] Central America, and Near East), FY1997 [19] (continued)

Disaster	Number	Total USG assistance[b] (thousands of dollars)	Countries
Debris flows	0		
Volcano	0		
Fire	1	15.2	Guinea-Bissau
Technological	0		
Complex Emergency	13	84,652	Angola
		25	Central African Rep.
		45,998	Liberia
		26,297	Sierra Leone
		52,000	North Korea (food emergency)
		39,898	Afghanistan
		12,364	Northern Iraq
			Horn of Africa[c]_____
		12,423	Somalia
		65,401	Sudan
			Great Lakes Region___
		29,719	Rwanda
		11,029	Burundi
		11,775	Dem. Rep. Congo
		3,365	Uganda

a. Countries bordering on the Pacific. European and Former Soviet Union countries are excluded from this table.

b. $25,000 is the amount an ambassador can unilaterally request in direct support.

c. Colors indicate groupings of associated crises.

Table 47 does not claim to be an exhaustive list of operations. Many smaller operations were not included; nor were U.S. missions to UN peacekeeping operations (such as the Suez, Macedonia, or Cyprus). It does, however, list most of the named JTF and other operations occurring between 1990 and 1997.

Table 48 lists forcible-entry operations that occurred during the same time period. A much broader time period is covered in this table than in table 46; it goes back to the late 1950s.

Table 47. Major operations in which Navy or Marine Corps forces
participated[a] 1990-1997 [21–26]

Disaster	Name	Year	Country
NEO/Evacuation/ Embassy Support[b]	Sharp Edge	1990	Liberia
	Eastern Exit	1991	Somalia
	Quick Lift	1991	Zaire
	Silver Compass	1992	Liberia
	Distant Runner	1994	Rwanda
	United Shield	1995	Somalia
	Assured Response	1996	Liberia
	Quick Response	1996	Central African Republic
	Noble Obelisk	1997	Sierra Leone
	Silver Wake	1997	Albania
	Guardian retrieval	1997	Congo/Zaire
Refugees	Provide Comfort	1991-present	Iraq
	Safe Harbor/JTF GTMO	1991-1993	Cuba/Haitian refugees
	Able Manner	1993-1994	Cuban refugees
	Amber Value	1994	Chinese migrants
	Able Vigil	1994	Cuba
	Support Hope	1994	Great Lakes Region
	Safe Haven	1994-1995	Panama
	Distant Haven	1994	Suriname
	Sea Signal	1994-1996	Caribbean/Haiti
	Safe Passage	1995	Cuba
	Guardian Assistance	1996	Rwanda and Congo
	JTF Marathon	1996	Wake Is.
	Pacific Haven	1996-1997	Kurdish refugees/Guam
	Provide Comfort	1996-1997	Iraq
	Present Haven	1997	Cuba
Peacekeeping	Multiple[c]	1992-present	Bosnia
	Restore/Continue Hope	1992-1993	Somalia
	Assured Lift	1997	Liberia
	Safe Border	1995-1997	Ecuador/Peru
	Multiple[d]	1993-1997	Haiti
Disease		1990	Venezuela
Storm		1990	Tunisia
	(Hugo)	1990	Antigua
	(Mike)	1990	Philippines
	Hurricane OFA	1990	Guam
	Mud Pack	1990	Phillipines
	Sea Angel	1991	Bangladesh
	Balm Restore	1991	American Samoa
	JTF Marinas	1992	Guam
	JTF Eleuthrera	1992	Bahamas
	Typhoon Paka	1997	Guam

Table 47. Major operations in which Navy or Marine Corps forces participated[a] 1990-1997 [21–26] (continued)

Disaster	Name	Year	Country
Earthquake		1990	Philippines
		1993	Guam
Drought	Water Pitcher	1992	Micronesia
	Provide Relief	1992-1993	Somalia
Volcano	Fiery Vigil	1991	Philippines
	Hot Rock	1992	Italy
Technological		1992	Honduras

a. Operations executed by U.S. Navy or Marine Corps forces; many more were planned. For a detailed discussion of which operations were, or were not, included in the database see [21,24]. In addition to the operations defined there we exclude smaller-scale operations such as fire fighting or search and rescue. We also exclude domestic operations with the exception of Pacific islands such as Guam or Samoa.

b. Non-combatant evacuation; this category also includes evacuation of embassy or other personnel and embassy security operations. It does not include USMC (FAST) or Navy (SEAL) embassy deployments.

c. Includes operations Sharp Guard, Deny Flight, Quick Lift, Deliberate Force, Joint Endeavor., Joint Guard, Joint Forge

d. Included operations U.S. Support Group Haiti (Haiti Assistance Group), Support Democracy, Uphold Democracy.

Table 48. Forcible entry, or military operations short of war [23]

Type	Country	Name	Year
Benign amphibious entry	Lebanon		1958
Administrative entry[a]	Dominican Republic	Power Pack	1965-1966
Raid	Cambodia		1975
Forcible entry	Grenada	Urgent Fury	1983
Deterrence	Honduras	Golden Pheasant	1988
Forcible entry	Panama	Just Cause	1990
Entry/withdrawal	Somalia	Restore Hope/United Shield	1992/1994/ 1995
Administrative entry	Haiti	Uphold Democracy	1994

a. Entry of forces without significant resistance; this can range from an assault-style entry with no resistance to landing via commercial aircraft.

Appendix B: Worldwide emergencies

This appendix expands on the figures shown in the text to include worldwide emergencies (figures 30 and 31), food-deficit countries (figure 32), and least-developed countries (figure 33).

Figure 30. Complex emergencies (worldwide) to which UN responded [20]

New emergencies in 1998
New emergencies in 1997
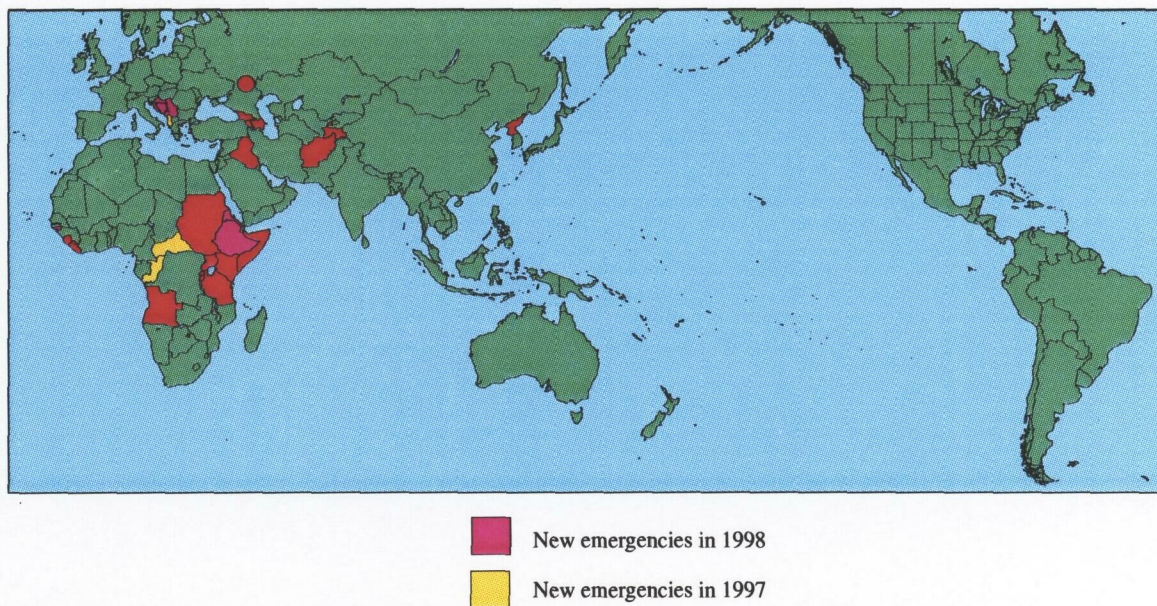
Figure 31. Complex emergencies (worldwide) to which U.S. responded [9, 20]
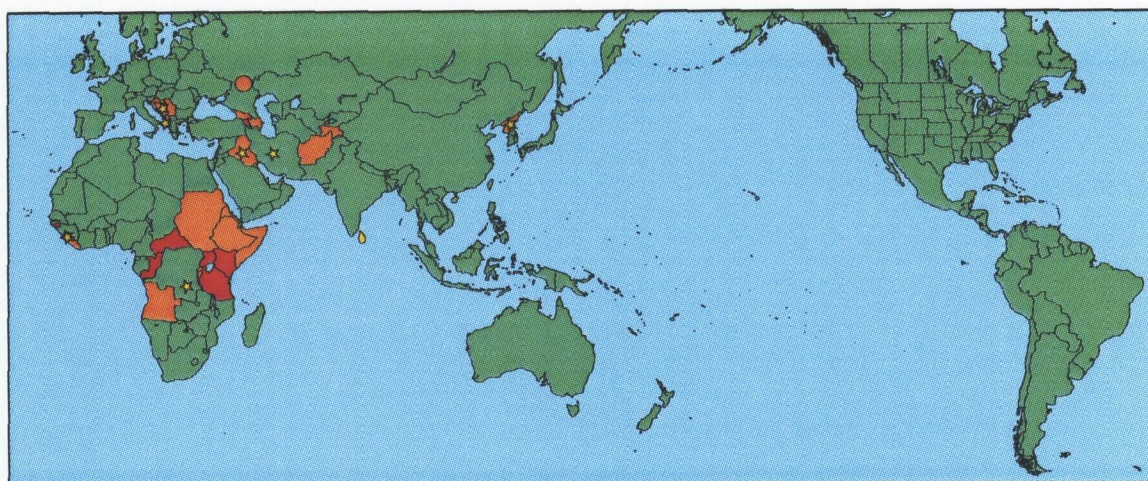
■ U.S. and UN complex emergencies

■ UN complex emergency

□ U.S. complex emergency

★ DIA worldwide hotspots

Figure 32. Food-deficit countries (worldwide) [18]
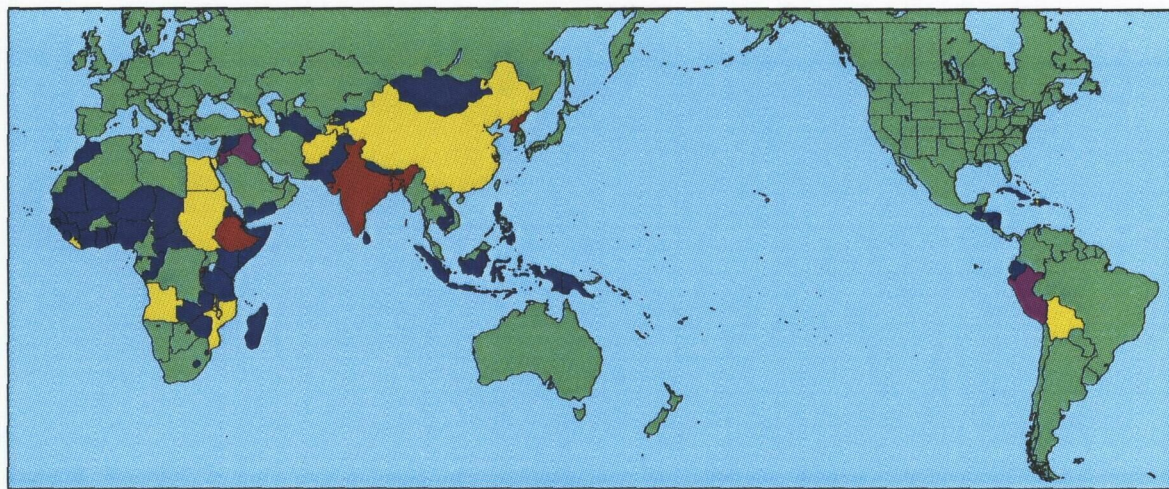
■ Iraq, Jordan, and Peru are not "low-income/food deficit" but receive more than 100,000 tons/year

■ <100,000 tons/year, low income/food deficit

■ 100,000 – 300,000 tons/year, low income/food deficit

■ >300,000 tons/year, low income/food deficit

Figure 33. Least-developed countries (worldwide) [18]
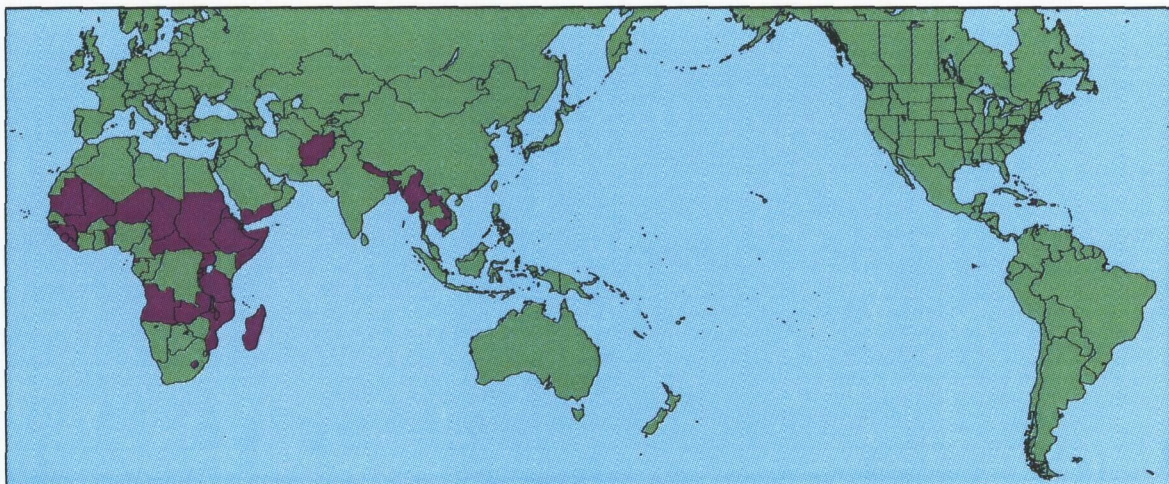
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